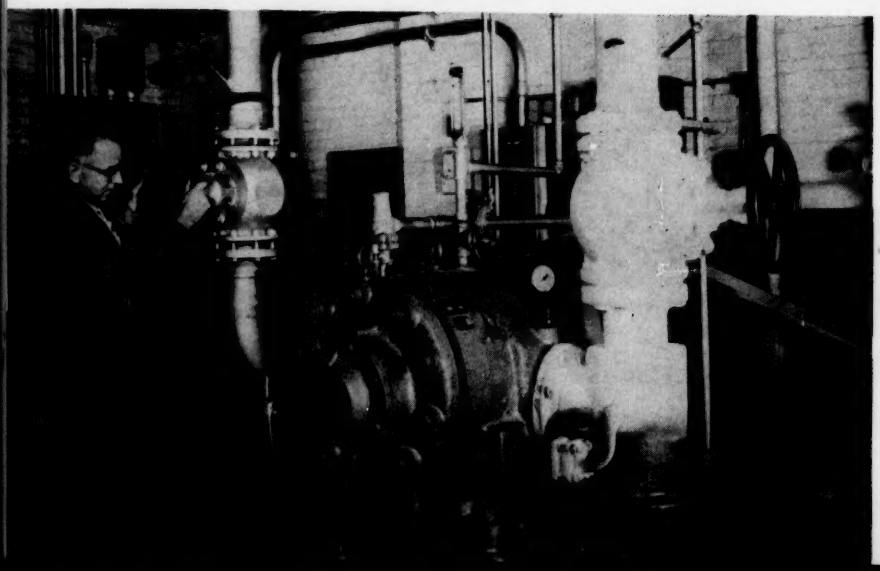

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genetron 12

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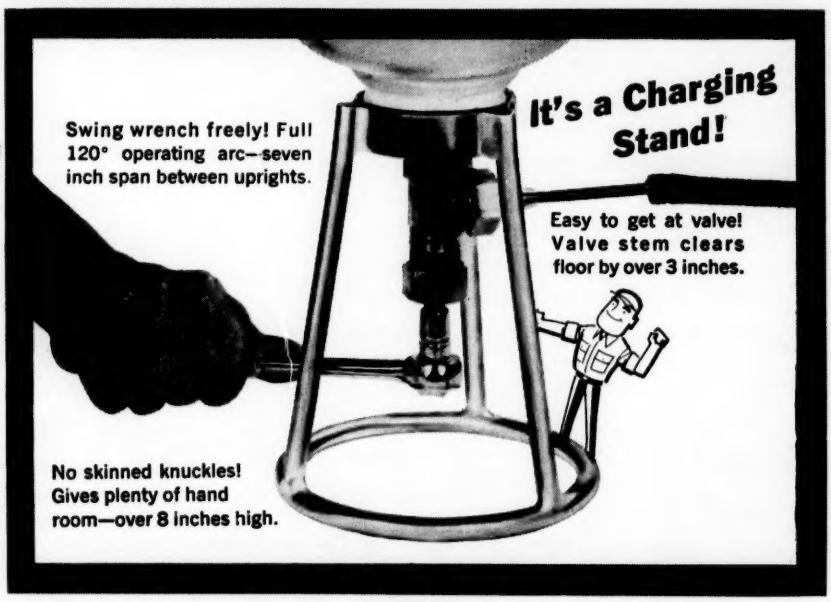
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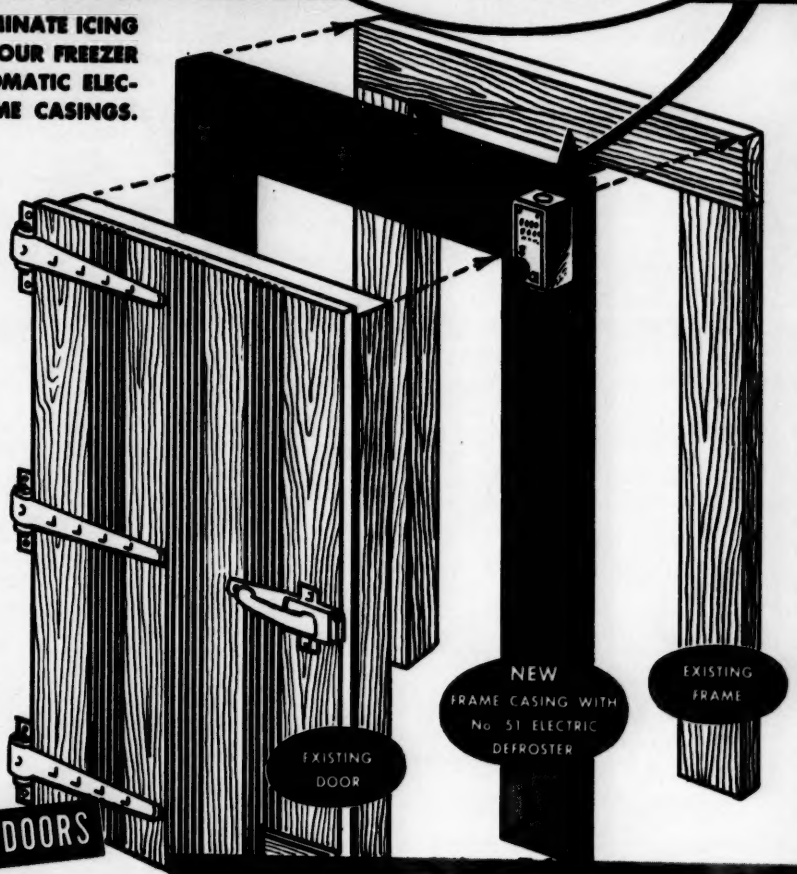

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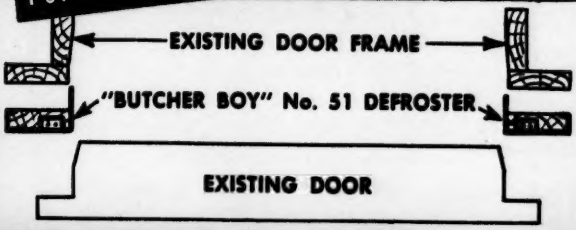

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June, 1959

Number 6

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Where can literature be found on ammonia refrigerant safety, was asked frequently. The Question Box Committee put together a table of those currently available.

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COVER: Two Lines Into Hardening Room Achieved With Rotary Booster, Third Stage At Foremost Dairy Inc. Plant

▶ MULTI-STAGING for optimum low temperatures in ice cream hardening often provides additional intermediate capacity. Booster compressors of the rotary type were applied to the Woodlawn Farm problem. Two production lines conveyed into the hardening room represent added freezer capacity as well as hardening.

Published Monthly by NICKERSON & COLLINS CO.
General Offices: 433 N. Waller Ave., Chicago 44, Ill. Teles.: AUstin 7-1303-04-05

news briefs of the month

Free Pre-Cooling For Maine Potatoes

Pre-cooled cars for potatoes will be provided with up to 5,000 lbs of ice without charge to aid the Spring movement of Aroostook potatoes. This announcement came from J. T. Clark, vice-president-Traffic, the Bangor and Aroostook Railroad, in mid-May. Pre-cooling on this basis was tried experimentally by the railroad in 1958 as an added inducement to ship by rail. Clark explained that the railroad had enough ice stored to service 3,000 cars. Free icing will stop when the ice supply is exhausted.

Constructs Pilot Plant For Sulphite Freezing

Using laboratory-scale equipment, Herbert H. Clark, Oshkosh, Wisconsin, consultant, demonstrated a new process for freeze concentration of sulphite liquor used by pulp manufacturers, at a recent meeting of the Sulphite Pulp Manufacturers Research League. Clark is now constructing a pilot plant with capacity to concentrate two gpm by his freeze process. Freeze concentration can cut costs and yield a better product than present evaporation methods, and substantially larger tonnages of sulphite liquor can be marketed, according to Averill J. Wiley, League technical director. Clark's development was reported in the PAPER TRADES JOURNAL.

Refrigerant In Dual Role

Refrigerant 12 is now used to help cook meat in half the usual time by means of "Thermo Pins". These simple sealed tube devices are now being introduced commercially. Inserted in a roast or a fowl the pins pick up heat through fins and transmits it to the refrigerant, which in turn relays the heat to the interior of the product eliminating basting and reducing evaporation.

Usefulness of these devices, according to DUPONT, is not limited to cooking. To cut meat freezing time in half the pins are inserted into the meat and placed in the freezer. Once the meat is frozen the pins can be removed. To thaw the meat the pins can be replaced in the original holes which causes heat to be pumped from surrounding air directly into the meat.

Rocky Mountain Salmon From Frozen Swedish Roe

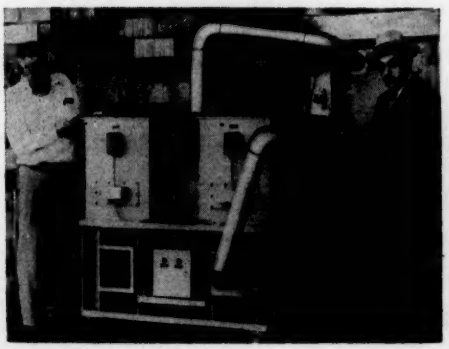
Flown from Sweden to the U.S., five thousand would-be salmon in the form of fresh roe were shipped from the Swedish Fish-breeding Institute at Dejefors, Varmland to the U.S. Fish and Wild Life Service breeding station at Leadville, Colorado. The shipment was undertaken by SAS and was guaranteed to be kept at O F. The roe was intended for experiments by the F&WLS. This particular breed is a land-locked salmon.

Fish Freezer, Storage For Pascagoula, Miss.

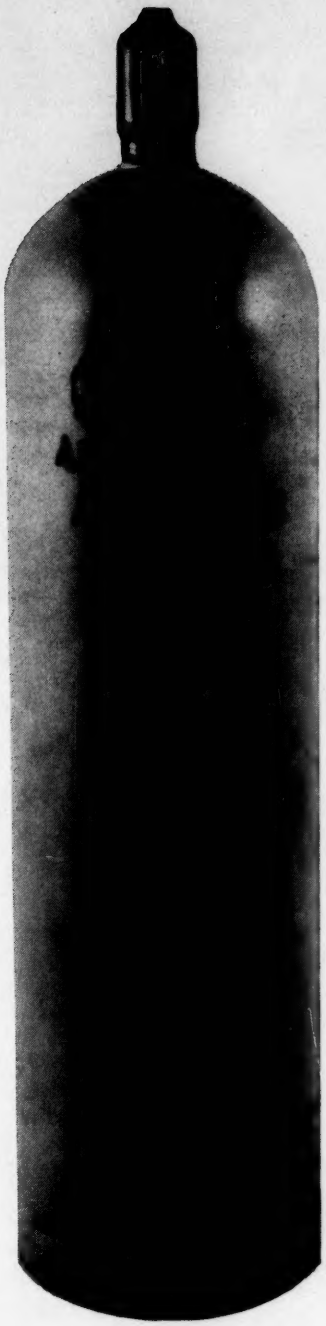
International Tuna Corp., Drake-Wilson Div., will build a $100,000 blast freezer and storage plant in Pascagoula, Miss. According to the MISSISSIPPI NEWSLETTER, the company processes and freezes trash fish unsuitable for the edible market and markets them to some 5000 mink ranches in the U.S. The company is working toward distribution of 15,000 tons, annually.

Correction Department

▶▶ **May issue, IR, has a caption incorrectly identified. On page 15 under the headline "Controlled Humidity at One Cent per Cubic Foot, all illustrations were mistakenly identified. The three views are those of Oswego Netherland Co. Inc., Oswego, N.Y., and the gentleman at the right is Mr. H. B. Lasky, president, and Mr. Jack Avery, Supt. left.**



"NATIONAL" ANHYDROUS AMMONIA



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Wichita, Kansas.....Barada & Page, Inc.

B-P

What's New

MACHINERY
APPLIANCES • PROCESSES

▶▶WHEN TO DEFROST has always been as much an economic problem as operating refrigerated facilities in such a way as to minimize shrinkage with meat products. Now proven as practical, is a control assembly which produces operation sequences at temperatures wanted, with exceptionally good results for meat and fish storages.

▶THE BOSSMAN CONTROL, pictured, consists of three thermostats with relays and other electrical gear which provides a sequence of operation selected by the owner or operator. Specifically, the equipment starts refrigeration on a defrosted coil temperature and product request for refrigeration; stops refrigeration on satisfaction of product temperature; and automatically defrosts when and if ice impairs refrigeration, automatically placing the system back in operation as defrosting ends.

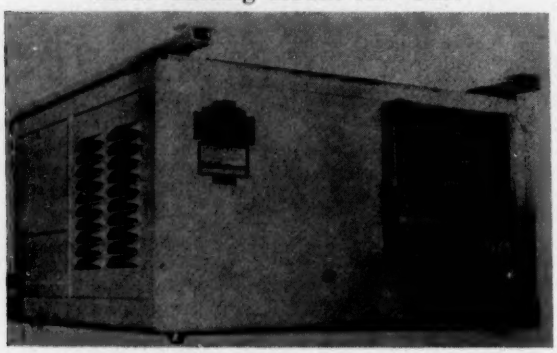
Modern products storage conditions demand closer differential in refrigeration temperatures. Plus or minus 8 to 10 F will no longer be tolerated. The operator or owner frequently wants to change his own temperatures and modern equipment generally gives him an opportunity to "dial it". However, in making any changes, the operator does not want to dial in frost troubles, says the manufacturer of this control apparatus.

Sold on a money back guarantee, the Chicago firm offers two models; a heavy duty unit for industrial applications and a smaller model for commercial establishments. In addition to meat and fish applications at the distributor level the firm has manufactured controls for hotels and hospitals. A laboratory and a florist have also recently installed these controls for large biological storage and wholesale cooler, respectively.

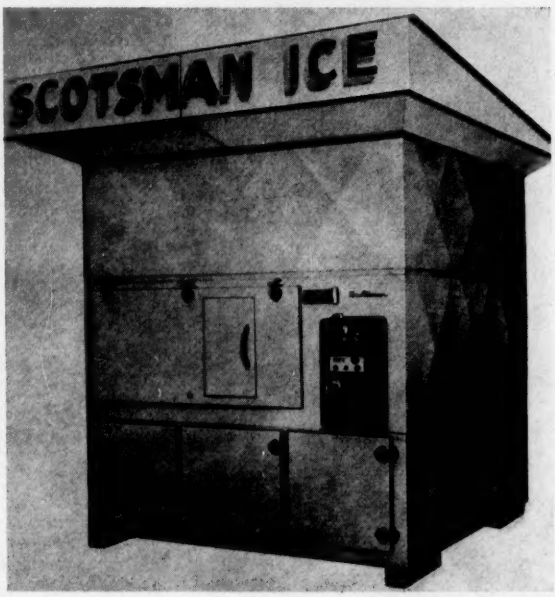
Portable Display

▶DAIRY MONTH will undoubtedly find a number of dairy product promotion efforts at the retail level. The *Frigid Spot*, an insulated portable refrigerated dump, pictured, is typical of a number of such units being manufactured. Insulated with 2-inch thick planks of *Styrofoam*, this unit by a Van Nuys, California manufacturer has been used successfully with water ice for marketing cooler type dairy products and produce for the on-the-spot sales. For lower temperature quick-sale product display, dry ice is used as expendable refrigerant. A Denver, Colorado firm features similar display boxes constructed of *Dylite*, another polystyrene material.

Meat Cutting Room Air Unit



▶ AIR DISTRIBUTING UNITS for meat cutting rooms were announced early in the Spring by Recold Corp., Los Angeles. They are especially designed to maintain 50 to 55 F in meat cutting and packaging rooms for wholesale meat purveyors, supermarket commissaries and warehouses. Rated from 2 to 5 tons, the units may be installed outside a cutting area and ducted into the room. Motor and drive are separated from air stream and the housing is completely insulated. White baked enamel, the units are equipped with cleanable filters at the inlet side and the moving parts are heavy duty galvanized.



Coin Operated Vendor Makes Its Own Ice

▶ SAID TO BE the first of its kind ever made, a coin operated ice vendor which manufacturers and packs its own ice has been announced by an Albert Lea, Minnesota firm. It is designed for the customary vending station location, and will make and dispense either cubed ice, crushed ice, or both, bag or bulk.

Ice is manufactured by any combination of up to four self-contained automatic ice machines, housed in the top section. As ice is made it is fed to the refrigerated lower section. The middle section holds bag packing and coin mechanisms. The bottom section is the ice storage area.

The bottom section contains three storage compartments all refrigerated, one for bulk ice and two for bagged ice. When cube and crushed ice is made another divider is inserted to separate those two types. Designed for interlocking assembly and various combinations, sections of the vender are six foot square.

(Continued on Page 38)

Engineering the temperature...

LESS THAN ONE PERCENT SHRINK

Recold Water Defrost Units hold shrink to less than one percent in a daily kill of 2,200 hogs at Crawford County Packing Plant, Denison, Iowa. Recold will provide the same solution to your shrink problems.

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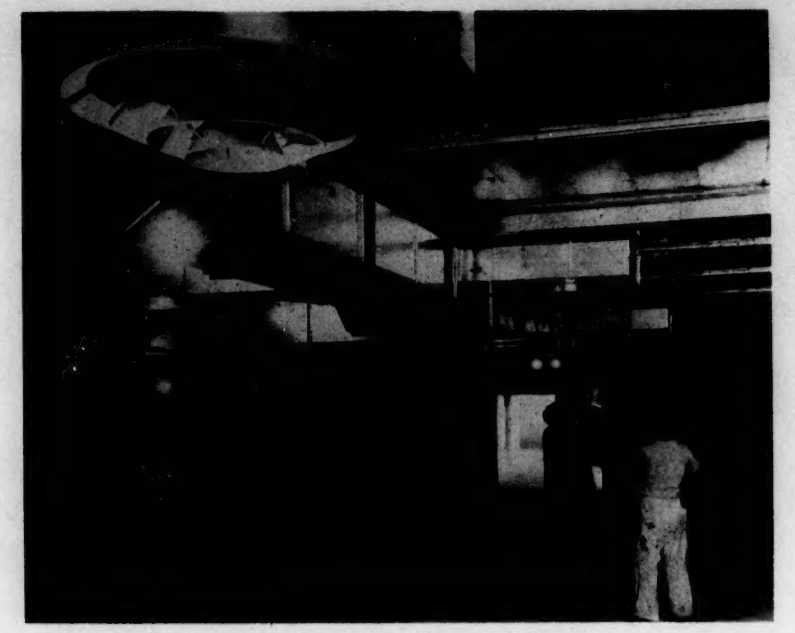


Fig. 1 — Minimum maintenance ceiling is a feature in the Howard Johnson cold rooms. Interlocking metal pans placed on steel channels, support 10-in. insulation. Sheet metal duct, also supported from the channels, distributes the air. (The plasterer was curious as to the function of the duct work, so the engineer takes him aside to make a few pointers).

New Ice Cream Plant for Howard Johnson Inc.

Second Increment Started in Englewood, N. J.

Fig. 2 — Properly scoring the outer coat of the finished insulation, this plasterer tends to prevent contraction cracks in the hard outer surface. One wall remains to be finished with two coats of Portland cement plaster. Sharp freezer door at left is by Jamison Cold Storage Door Co., and is equipped with a *Frostop* element to prevent icing and subsequent freezing.

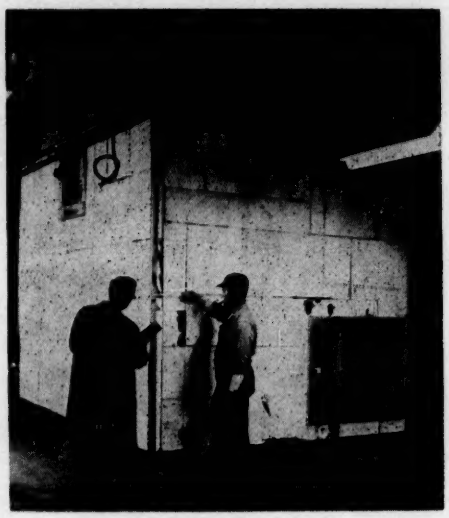


Fig. 3 — The King unit is insulated in the same manner as the hardening room and to the same thickness. The two Jamison Vap-r-tyt doors at right are provided for defrosting operations, and the door at left for access to the blower and duct damper.

▶▶▶ REPLACING ITS OLD FACILITIES IN BRONX, N. Y., Howard Johnson, Inc., has completed and is now operating a modern ice cream plant in Englewood, New Jersey.

The old plant was periodically expanded over 16 years, with chopped-up space the result. Where there were seven small hardening rooms in the Bronx facility, the new plant completed for Summer 1958 production, boasted a single spacious room capable of hardening and storing over 25,000 gallons at once, or an annual volume of one million gals.

A King Company sharp freezing unit provides the necessary low temperatures with turbulent rigid air movement from ceiling ducts (see Fig. 1). The Creamery Package Mfg. Company supplied and installed a booster compression refrigeration system which serves the ingredients and raw products receiving storage room, mix tanks, pasteurizer, ice cream freezers, and the new large hardening and storage facilities.

With the exception of one new ice cream freezer and a few pieces of ice cream mix processing equipment, the storage tanks, blending vats, pasteurizer and three freezers were transferred from the Bronx establishment. The new plant was planned and placed in operation in such a manner that the equipment was transferred from the old to the new location without any serious interruption of production.

Polystyrene Insulation

As in any confined space in which temperatures of minus 30 F must be maintained, a key factor in the construction of this modern plant was insulation, in this instance *Uni-Crest*, an expanded polystyrene material manufactured by United Cork Companies, Kearney, New Jersey.

In this plant *Uni-Crest* has been applied in 10-in. thicknesses under the floor, against the walls and over the ceiling. Even the supporting columns have been given similar protection. Smooth structural surfaces are provided by pouring a five-in. thickness of concrete directly over the insulation to form a heavy-duty floor, by applying ordinary scratch and finished plaster coatings one-in. thick to both interior and exterior walls, (shown in Figs. 2 and 3) and by using easily cleaned, light weight galvanized metal pans to support the ceiling insulation (see again Fig. 1).

Hardening of the ice cream is accomplished by low temperature air movement from a blast freezer designed and furnished by the King Company of Owatonna, Minnesota.

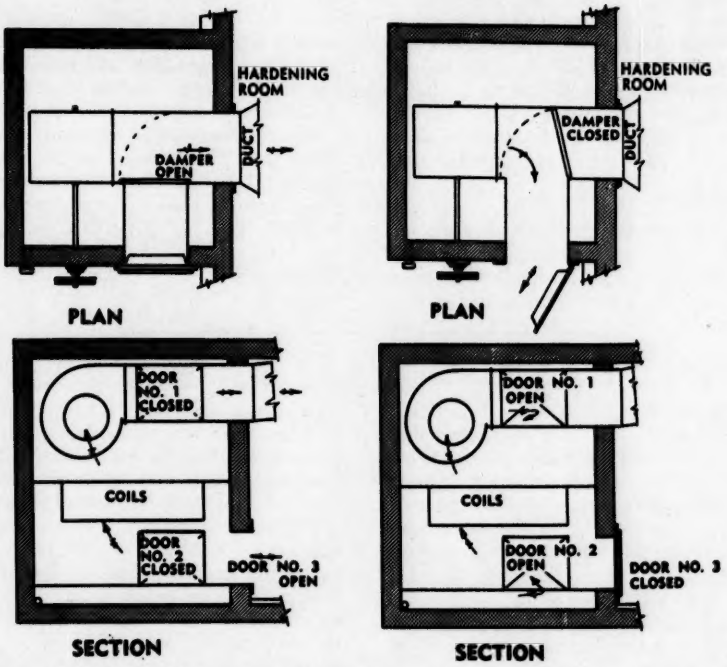


Fig. 4 — Top and bottom figures at left, are the plan and section of the blast freezer in hardening operations. The top and bottom doors (Nos. 1 and 2), are closed and duct damper and door No. 3 are open. Figure 5 — top and bottom views at right show plan and section of the freezer during defrosting operations. Duct damper and partition door are closed; sharp freezer doors No. 1 and 2 are open.

Blast Freeze Application

Blast freezer consists of ammonia refrigerant coils, blower duct work, damper and sharp freezer doors arranged in an insulated compartment outside the hardening room.

Air is pulled from the hardening room through a door opening at the base of the partition between the blast freezer and the hardening room. The air moves upward through the refrigerant coils into the blower scroll. The blower discharges the air through the duct work and the diffusers pictured in Fig. 1. The air passes through palletized loads of packaged ice cream to the opening previously described.

The King unit is arranged for delivering its low temperature air to the hardening room as Fig. 4 shows. Defrosting is accomplished as shown in Fig. 5. Manually, two defrost doors are opened in the wall of the blast freezer compartment which is outside the hardening room (these are the two doors pictured at right, Fig. 3).

A damper in the delivery duct closes to prevent discharge into the hardening room and another door, normally open for the blast freezer inlet, is also closed. Air is taken in and upward through the coils and discharged out through the top defrost door in the King unit. Operation is similar to intake and discharge during hardening operations, except that warm air is taken from the surrounding area.

The unit is defrosted every other day in Summer, to every fourth day in the Fall and Winter. Defrost takes from 15 to 30 minutes. Hardening room temperatures are not effected during the defrosting.

Two-Stage Refrigeration

The refrigeration system designed by The Creamery Package Mfg. Company is their typical two-stage system employing Type K multi-cylinder ammonia compressors and boosters. Suction from the King blast freezer and ice cream freezers is taken through a low pressure suction trap from which the booster operates. Discharge from the booster compressor is to a liquid cooled intercooler.

The second stage compressor takes suction from intermediate pressure plant demands via the intercooler, and discharges to a Baltimore Air Coil evaporative condenser mounted on a platform at the rear of the plant. The system is arranged for maintaining temperatures in the receiving cooler and holding room by single stage compression, after peak production and hardening has been accomplished.

. . . More ♦

Howard Johnson (cont'd)

New Expansion

Although the new plant at Englewood is barely a year old, a second King unit and two additional CP compressors (a booster and high stage) will go on the line to meet expected 1959 production demands. A second hardening and holding room approximately the same size as the original was completed this Spring.

Insulation Features

In the Howard Johnson installation, three individual slabs of Uni-Crest 3-, 4- and 3-in thick have been laminated with mastic into solid panels 10-in thick, all corners being interlocked. These panels are anchored to standard wooden framing by galvanized fasteners. Light weight wire mesh was used as additional reinforcement because of the thickness of the finished plaster.

"Hardening room efficiency depends upon both the proper engineering of the freezing unit and the effectiveness of insulation," says Mr. George R. Pitman, Production Manager for the Company plants. "The efficiency of the new hardening rooms will easily allow us to withdraw and ship whatever quantities of ice cream we need, in perfect condition, after only 24 hours of hardening".

Plant Manager and Chief Engineer at Englewood, is Herman S. Faust.

Frozen Semen Use Gains

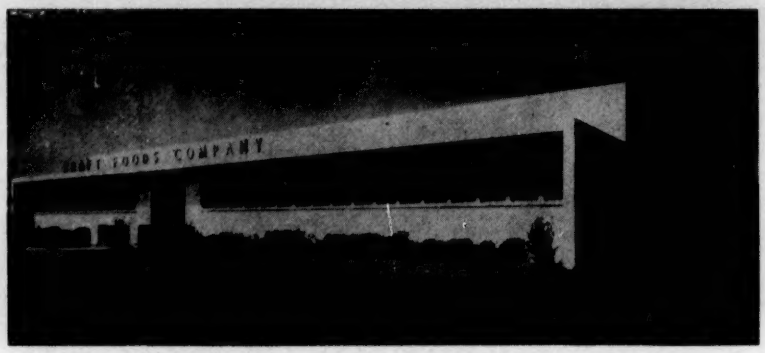
▶▶ACCORDING to the South Carolina AGRICULTURAL RESEARCH Magazine, May 1959, 85 percent of the dairy cattle of South Carolina are being bred with frozen semen. Semen of many different breeds is available through county associations in that state. Research work has been carried on at Clemson Station, S.C.

New storage facilities are being considered for holding the frozen semen after it has been collected. According to the DAIRY DIGEST, storage is one of the more important phases of the entire program. Semen during storage must be held at temperatures low enough to insure fertility once it is thawed; minus 140 F.

Salem Dairy Plant

▶▶CONSTRUCTION of a plant on a 10-acre tract in Salem, Oregon, for Curly's Dairy was undertaken in May. According to James L. Payne, architect, plans call for a 164 x 284 ft. reinforced concrete building with structural steel frame and a steel roof. Plant will have complete facilities for processing milk and cottage cheese.

California Ice Cream Companies Merge, Announce Purchase of Local Kraft Plant



Los Angeles Plant of Kraft Foods Becomes New Home For Merged Beverly Franilla Firms, an Independent Producer

▶▶▶BEVERLY FRANILLA DAIRIES, Ltd., is the name of a new firm which resulted from a merger of two of the West Coast's largest independent ice cream companies. Announced at Chicago in mid-May was the consolidation of Beverly Dairies, Ltd., 230 West Jefferson Blvd., Los Angeles, and Franilla Ice Cream Co., 9532 State St., South Gate, California.

The new firm will take over the Kraft Foods Co. plant at 5657 East Slauson Ave., Los Angeles, early in 1960. Negotiations were completed at the Kraft headquarters in Chicago recently. Approximately $1 million will be spent in remodeling and equipping the present 65,000 sq. ft. building. The new Beverly Franilla Dairies, Ltd., will be geared to produce seven million gallons of ice cream annually.

Chicago Firm Invests

Announcement of the merger and the property purchase was made simultaneously by Worth Kemps, president, and David Bresler, treasurer of Beverly Dairies, and Willard D. Bretz, vice-president of Franilla. Bresler is a founder and major stockholder of the Bresler Ice Cream Co., Chicago. A substantial amount of stock in the new firm will be held by officers of the Bresler Co.

By occupancy time the building will be enlarged to 80,000 sq. ft. It is located on 7¼ acres which will provide for the receiving and shipping of the firm. Included in the remodeling and equipping is a new engine room, several sub-zero freezer rooms and a large mechanial ice cream cabinet repair and storage room. The merger and expansion will make the new firm largest independent ice cream manufacturer on the Coast.

Beverly Dairies, Ltd., known as the Globe Ice Cream Co. was founded shortly after the first World War. Franilla Ice Cream Co. was founded in 1929. The real estate transaction was handled by I. Simon & Co., of Chicago, and the Caldwell-Banker Realty Co. of Los Angeles.

Walla Walla Milk Plant

▶▶SCHEDULED FOR completion in June is a modern milk processing plant for Tomlinson's Dairy Marts, Walla Walla, Washington. Costing approximately $100,000, the new plant is the latest step in a family venture that has grown from one prize winning animal to a major business. In addition to milk processing, the firm will make ice cream, chocolate milk, buttermilk and other dairy products at the new installation.

Bernard Tomlinson indicated that all milk processing would be moved from the firm's Stateline dairy to the new plant. To complete the cow-to-consumer picture, the firm will operate stainless steel refrigerated tank trucks from their farms to the plant. Stainless steel refrigerated milk coolers are installed at each farm into which the milk automatically flows and is cooled until the arrival of the tanker, said the Walla Walla UNION BULLETIN.

The farms operate under Roy E. Tomlinson. The entire business got its start as a result of a Jersey calf which Bernard Tomlinson won in a contest conducted by a large business firm. The animal won dozens of firsts in 4-H and FFA contests, bringing recognition and finances for the first 50 Wisconsin Holstein calves upon which the Tomlinsons built their present herd.

An Argument Concerning

Liquid Ammonia Recirculation Systems

By WM. V. RICHARDS
H. A. Phillips & Co.
Chicago

Presented at
The Seventh Annual Dairy Engineering Conference
Michigan State University, Febr. 26-27, 1959

Will They Improve Plant Performance?

▶▶▶NEEDED BEFORE remodeling refrigerated equipment, or in building a new plant, is a good understanding of liquid circulation problems in the common types of dairy processing equipment; such as, milk coolers, cold wall tanks, storage coolers, ice cream freezers, sweet water coolers, ice accumulators, novelty freezers, hardening rooms, tunnels, intercoolers, and brine coolers.

Extravagant claims for increased evaporator efficiency with proprietary circulating systems have little relevance for the typical diary and ice cream plant. Most special equipment is designed by the manufacturer with *built-in* refrigerant circulation.

Summary Of Factors Affecting Heat Transfer[1]

Rate at which the boiling liquid moves over the heating surface has an important influence on the heat transfer coefficient, (h). Where no forced circulation is used, the rate of circulation is believed to depend on temperature difference, (Δt), and on the design of the evaporator. Data in large amounts has established quantitatively that the heat transfer increases with increase in Δt when the circulation is due to natural convection. The rate of circulation, and hence h, depends also on the dimensions and design of the evaporator, and on the height of the liquid.

A few data, taken where forced circulation was present, show little effect of Δt. The data examined show that the coefficient of heat transfer increases with increase in the temperature of the boiling liquid, other operating conditions remaining constant, and with decrease in the concentration of dissolved solids (oil and impurities) in the boiling liquid.

Depth of liquid level in an evaporator affects the overall coefficient of heat transfer to a substantial degree. Many tests on commercial evaporators show an increase in the overall coefficient with increase in depth of liquid up to a certain point, and then a decrease with increase in depth. The low h at very low liquid levels may be due to fluid covering only a part of the heating surface. The decrease of h with increase in liquid levels, at high liquid levels, is attributed in part to the effect of hydrostatic head on Δt; in part, to a change in circulation. Nevertheless, there is an optimum liquid level at which the capacity of the evaporator is at a maximum.

Types Of Two Phase Flow[2]

Since most evaporators have horizontal circuits with a low inlet velocity and a higher exit velocity, the *flow takes several forms* in the following order:

1.) *Bubble flow*–separate bubbles move along pipe at the same velocity as the liquid.

2.) *Stratified flow*–liquid flows along the bottom of the pipe and gas flows above over a smooth interface.

3.) *Wave flow*–similar to stratified flow except that the gas moves at a higher velocity and the interface is disturbed by waves.

4.) *Slugging flow*–level of the interface rises and falls, and frothy slugs pass periodically along the pipe at a much greater velocity than the liquid.

5.) *Annular flow*–liquid flows in a film around the pipe wall and the gas flows at a high velocity through the central core.

Forced Convection Methods Determine Evaporator Types

Because almost every conceivable shape of direct expansion evaporators are useful in the food business, refrigerating engineers cannot generalize about feed methods. Current methods of achieving circulation are:

1.) *Simple boiling*–open shell equipment characterized by a free release of vapor from a liquid surface, the formation of nuclear bubbles on the heating surface, followed by a break away and rise through the liquid, agitates the liquid in contact with the heating surface; thus, giving excellent heat transfer. This is an ideal type of refrigerant evaporator giving excellent heat transfer with minimum pressure loss. (A boiling pan of water is the commonplace example. Shell and tube water and brine coolers with vapor domes are the refrigeration counterparts.)

2.) *Thermal siphon*–tubular equipment of parallel circuits connected with headers where nuclear boiling (i.e. formation of bubbles) reduces the density of the mixture in the risers, inducing a circulation because of the greater density in the downcomers. (A percolating coffee pot is the commonplace example. Float valve and surge drum applications to ice cream freezers, ice flake machines,

[1] McAdams, HEAT TRANSFER, 1933 Ed., McGraw-Hill Book Co.

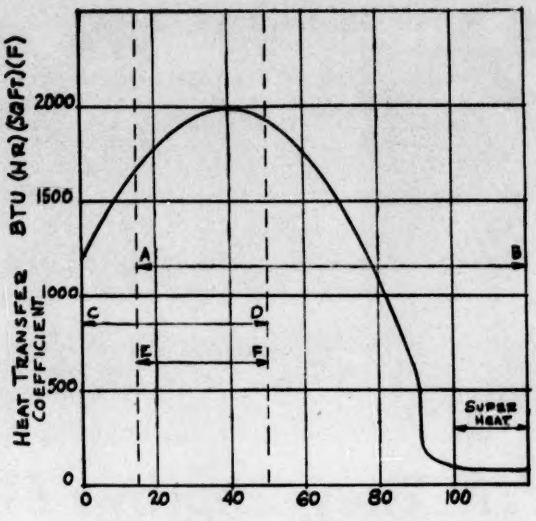
[2] Flow of Gas-Liquid Mixtures, O. P. Bergelin, CHEMICAL ENGINEERING PROGRESS, May 1949

Continuing: Will Circulation Improve Plant Performance?

Ample practical evidence illustrates the benefits of liquid circulating systems with ammonia refrigeration. This paper discusses what actually occurs in the evaporator in terms of types of boiling, heat transfer, types of flow, the liquid contents of the coil, and pressure drop.

Problems associated with circulation through two types of evaporator construction are outlined.

Point is made that savings in power at the compressor by eliminating excessive superheat and slopover, are far more important than the savings possible through more positive circulation in the low side.



VARIATION OF BOILING HEAT TRANSFER COEFFICIENT AT DIFFERENT QUALITIES. (WATER)

A-B SUPERHEAT CONTROL
C-D FLASH GAS BY PASS - RECIRC. (1:1)
E-F INJECTOR RECIRCULATION (1:1)

Fig. 1 — Graph depicting percent of feed vaporized.

cold wall tank jackets, sweet water coils, ice builders, and air coolers, are refrigeration counterparts.)

3.) *Injector siphon*—recirculation is induced by using the throttling losses inherent in the expansion cycle to do useful work; the flash gas imparts extra mass velocity to the evaporating fluid. (This method probably gives the greatest heat transfer with the least amount of liquid charge and is particularly useful in water coolers and ice cream freezers where large heat transfer coefficients are necessary at small temperature difference, or with surge drum below evaporator.)

4.) *Dry expansion*—accomplished with the thermostatic expansion valve which requires 4° to 10° F. superheat at the outlet of the coil to maintain feed. (It is used in tubular coils with long circuits. The condenser pressure is the forcing head.)

5.) *Wet expansion*—by allowing a controlled amount of slop over, a direct expansion circuit can show better efficiency than a dry or superheated expansion. This is accomplished with balancing valves and a liquid recirculating or return system. (This method is useful in multiple evaporator installations such as truck plates, cold wall tanks, and room coils for coolers and freezers.)

All five of these methods are positive circulation in one sense. Remainder of this discussion is primarily about *thermal-siphon* and *wet expansion* since the same coil condition can be achieved with both and their relative merits are more controversial. Also, though many economic as well as practical considerations are involved in the selection and use of equipment, this discussion is primarily concerned with seeking an answer in terms of more efficient operation.

Heat Transfer, Pressure Drop In Boiling Forced Convectors

Data on the variation of boiling heat transfer coefficient at different quantities for water shows that as the liquid feed is vaporized, an increase in heat transfer effect results up to 40% vaporized (See Fig. 1).

If this is true for refrigerants, the substantial improvement in capacity achieved with wet expansion (represented from C to D) over dry expansion with superheat (as in A to B) is explained. (Peak of this curve for ammonia is probably to the left, while for the halo-carbon refrigerants it is probably to the right.)

There can usually be circulated seven times the evaporation rate with ammonia without severe pressure drop penalties. While with heavier refrigerants, particularly the halo-carbons with low specific vapor volumns, there can only be circulated two times the evaporation rate.

If the best heat transfer with forced convection of ammonia occurs with about 1/3 of the feed vaporized, the best circulating rate would be 3 to 1; that is, with 33 per cent gas quality at the exit of the evaporator.

Two Unit Comparison With Top Feed vs. Bottom Feed, Controlled Head vs. Volume

Because many conflicting statements have appeared in published papers and manufacturers literature concerning plant design and the benefits of several liquid feed methods, a serious attempt is made here to reconcile conflicting statements in terms of two specific unit coolers, typical of those used in ice cream hardening rooms. (See Tables I & II).

Stoecker[3] and others say that "top feed" is better because: (a) it results in less pressure drop; hence a lower average boiling temperature and consequent lower product temperature; and (b), it results in less variation of liquid charge between full and low load condition.

Lorentzen[4] states flatly that the "bottom feed" gives more efficient heat transfer and more stable operation than top feed for the same evaporator.

Both of these statements tend to be true for a particular evaporator, but, as will be shown, there are several other factors to consider.

[3] Liquid Ammonia Recirculation, W. F. Stoecker, INDUSTRIAL REFRIGERATION V129 n5 Nov. 1955, Page 13-9

[4] Evaporator Design & Liquid Feed Regulation, G. Lorentzen, THE JOURNAL OF REFRIGERATION. Nov-Dec. 1958, Page 160-165

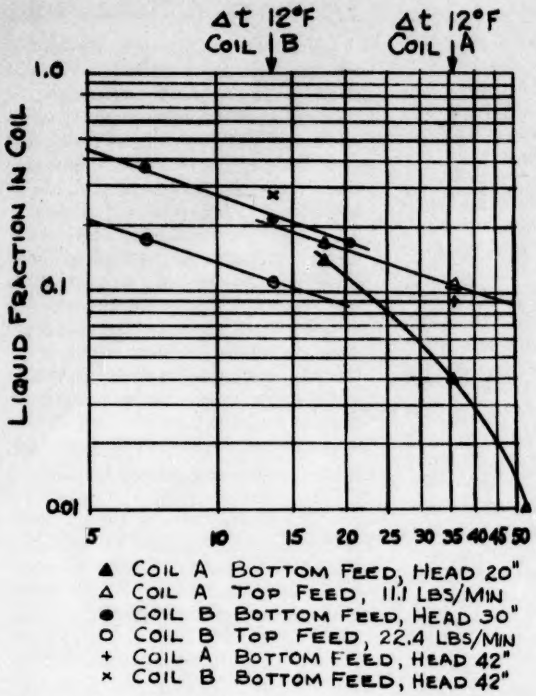


Fig. 2 — Comparison of coil exit vapor velocity (ft/sec).

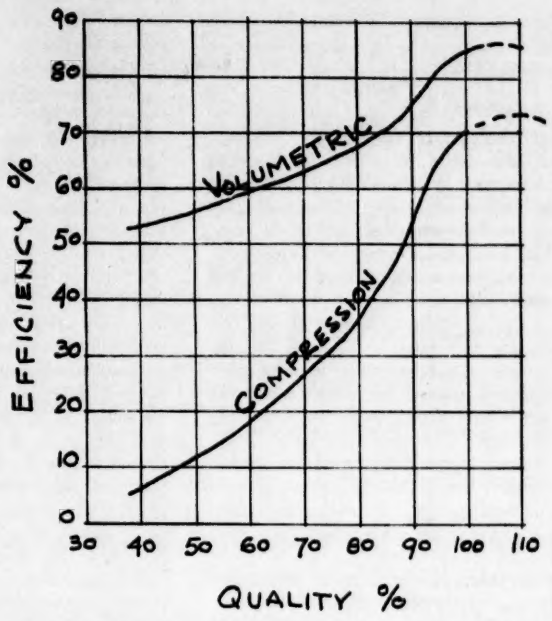


Fig. 3 — Effect of suction gas quality on volumetric efficiency. (Fisher)

Liquid Fraction Vs. Vapor Velocity

Limiting the comparison to recirculation at constant head with bottom feed vs. recirculation at constant quantity with top feed, some insights are gained. (Results of the author's calculations shown in Fig. 2).

Not too much faith is to be put in these calculations. (However, the mathematics is shown in appendix for those who wish to know the simplifying assumptions). There are so many random effects such as liquid slugging, liquid flow reversal, change of load, changing pressures, that reducing to mathematics defies reason.

A theoretical comparison of two different makes of hardening room unit coolers is shown in Fig. 2 to illustrate the effect of several feed methods on the circulation rate, liquid contents of coil, the pressure drop, and the boiling temperature. Make "A" is characterized by a high velocity of 35.5 ft/sec or heavy load per circuit which is typical of finned coils; while make "B" has a relatively low velocity of 13.5 ft/sec. at the coil outlet, typical of prime surface coils.

The liquid level is at the top row of the coil. The pressure drop through the coil and connecting pipes must equal the static head. Therefore from Fig. 2, and Tables I and II, it may be seen that coil "A" with a high tube load has a natural circulation-to-evaporation ratio of nine, with approximately 14 percent liquid fraction.

Coil "B" has a natural circulation rate of 20 with 22 percent liquid fraction. Increased circulation, wetted surface are due to lower velocities.

Doubling the head on coil "A" raises the boiling mean temperature nearly one degree F; or, stated another way, lowers the suction temperature nearly one degree to give the same air temperature. Approximately two percent more power is used for each degree increase in temperature difference from the liquid in the surge drum to the air. However,

Table I — Manufacturer's Data For The Two Coils Compared

Coil Data	"A"	"B"
Fan cfm	7100	22800
Fan h.p.	1½	15
Tube, inches O.D.	.75	1.05
Tube, inches I.D.	.67	.824
Rows deep	10	10
Linear feet	432	3081
Fins per inch	4	....
Parallel refrig. circuits	8	32
Face area, sq. ft.	10	29
Basic rating, Btu/hr°F	4760	9600

Table II — Coil Operation Estimated With Various Forcing Heads At Different Loads With Top Feed And Bottom Feed

Coil	Head ft.	Load tons	Pressure Drop psi	°F	Ratio Circ/Evap	Mean Evap Temp. F.	Liquid Fraction	Feed
A	1.35	4.76	.403	1.35	7	—41.33	.11	top
A	0.78	2.38	.234	0.78	14	—41.61	.18	top
A	1.67	2.38	.505	1.67	8	—41.17	.14	bot.
A	1.67	4.76	.505	1.67	1.5	—41.17	.04	bot.
A	1.67	7.14	.505	1.67	•	—41.17	.01	bot.
A	3.5	4.76	1.05	3.5	4.5	—40.25	.09	bot.
B	0.29	9.6	.086	0.29	7	—41.85	.11	top
B	0.12	4.8	.034	0.12	14	—41.94	.18	top
B	2.5	4.8	.755	2.5	63	—40.75	.38	bot.
B	2.5	9.6	.755	2.5	20	—40.75	.21	bot.
B	2.5	14.4	.755	2.5	3.7	—40.75	.17	bot.
B	3.5	9.6	1.05	3.5	33	—40.25	.27	bot.

•circulation stops

the recirculating rate is doubled while the liquid fraction increases from one to nine percent.

If the wetted surface increases as the square root of increase in liquid, the resultant tripling of the refrigerant side heat transfer will increase the overall co-efficient by about 50 percent which may reduce the leaving air temperature several degrees; thus, raising the head may lower the air temperature in spite of the boiling temperature rise.

Coil "B" with a constant volume circulation top feed has about 30 percent less wetted surface, as compared with the natural circulation that will take place with bottom feed. Greatly increased flow volumes would be needed (especially at light loads) to make top feed equivalent to bottom feed in Coil "B". Since most authorities quote a circulating-to-evaporating ratio of between two to 10 as being advisable, a ratio of seven was chosen as being representative.

Coil "A" on the other hand shows 66 percent more wetted surface with top feed than with natural circulation bottom feed. Natural circulation is that which takes place with the liquid level at the top of the coil.

It is observed that the coil design and load have an important bearing on the question of improving a plant by changing the coil circulation. Coils with reasonable vapor velocities will operate best with a head sometimes below the top row—just adequate to give good circulation with bottom feed. Coils with higher vapor exit velocities need greater heads and may operate better with top feed.

Air Flow Considerations

Another consideration should be the direction of air flow in relation to refrigerant. If the air is cross flow to the refrigerant, as in the two cases studied, it doesn't affect the choice of refrigerant feed. Downwards flow air indicates top feed refrigerant. Upwards flow of air indicates bottom feed in order to achieve the highest suction temperature.

Calculations such as the preceding, indicate that there is a certain liquid head for each evaporator that just balances the pressure loss at a desirable circulation rate. Any additional head causes a loss in efficiency. And contrarily, any less head will fail to deliver full capacity. There are practical reasons for providing extra head with pull down loads, where overloads may be expected as a routine operation.

Too much load for the available circulating head may stop circulation because of vapor binding. This phenomena, called film boiling blankets the surface with vapor, driving the liquid away just as drops of water dance on a hot plate or griddle.

With constant volume of liquid feed the recirculation rate is approximately an inverse function of vapor velocity. Cutting the load in half, cuts the pressure drop by about 40%, while the circulation to evaporation ratio doubles. With a fixed delivery head, the pressure drop remains constant and the reduction in velocity at light loads is compensated for by greatly increased circulation ratios and larger liquid fraction with bottom feed.

The interesting point to mention here is that the same conditions are obtained in a pump circulation circuit as in a float and surge with thermal siphon where the pressure head at the coil inlet is the same. The same liquid fraction and pressure drop result in the coil and suction return line to the accumulator.

An experiment by Lorentzen 4, recently published, strongly refutes the benefits of top feed. He claims the increased wetting action of bottom feed gives superior heat transfer in air cooling coils with either thermostatic expansion valve or forced circulation. The summary of his results is shown in Table III.

Need Individual Evaluation

Lorentzen found about 50% more capacity is available because of bottom feed as compared to top feed with TX valve. About 8% more capacity is available because of bottom feed as compared to top feed with the pump. An advantage of 11% is seen for recirculation vs TX valve. Most U. S. manufacturers show 15% advantage for wet expansion in their literature.

Each evaporator design has to be evaluated for the proper liquid feed. Where plenty of surface is available, the TX valve does yeoman duty. Large loads and low temperature coils are invariably flooded since hunting and distribution problems with TX valves become acute under these conditions. Gravity feed is the simplest way to provide the one proper circulating head for each evaporator. In large plants, especially with large air cooling coils at small temperature differences, or with many truck plates, a central pumping system is appealing because use of a central accumulator simplifies the piping and controls associated with the evaporator. Also, oil circulates back to the central accumulator where it can be drained at one point.

[5] Determining Pressure Drop in Freon Systems, W. L. Holladay, REFRIGERATING ENGINEERING, SEPT. 1954.

Effects At The Compressor[6]

Refrigerating engineers know that changes in vapor velocity due to changes in applied loads, or to changes in the compression capacity, will cause slugging in most coils. Also experienced, are liquid droplets carried in a stream of superheated vapor in the suction line. Vertical single acting compressors and horizontal double acting machines are capable of handling wet compression which results when liquid droplets carried into the cylinder are evaporated in the compression stroke. In fact, liquid injection is used purposefully in some booster applications for decreasing the work of compression.

Extremes of wet compression drastically reduce the volumetric efficiency, because the larger droplets do not all evaporate during the compression stroke but continue to evaporate during the expansion stroke. Furthermore, this liquid is now at the higher temperature corresponding to the discharge pressure, and a considerable portion of it evaporates almost instantaneously because the heat necessary is contained in the droplet, and need not be absorbed by heat transfer. The action is similar to flashing or passing through an expansion valve. The expansion stroke with wet compression therefore involves an increase in volume of the refrigerant remaining in the clearance space, reducing the volumetric efficiency without a proportional decrease in power.

Effect of Suction Quality On Volumetric Efficiency

Figure 3 shows that a 20 percent slopover reduces the compressor efficiency by half. This readily explains the really phenomenal and well documented effect that a suction accumulator and liquid return system can accomplish[7]. Actually modern compressors cannot tolerate this amount of liquid carry-over without damage.

Since the existence of a sustained slopover has been common in dairy and other multiple process food plants, a much greater opportunity for increasing plant efficiency exists in protecting the compressor with proper liquid control, as compared with the revision of liquid controls to the evaporator.

[6] ASRE DATA BOOK, DESIGN VOLUME 1955-56, Chapter 4 – Compression Cycles, Page 4-17.

[7] Ninety Year Old Brewery Cuts Compressor Use. INDUSTRIAL REFRIGERATION, V-130 n6, June 1956, Page 17, 18, 50.

Summation

Addition of a liquid return of circulating system to dairy plants is indicated to conserve power costs by eliminating slopover at the compressor, and to allow proper use of the many types of evaporator and feed methods in a common system.

Conversion to liquid circulating systems is indicated where there are many evaporators such as truck plates cold wall tank jackets, or room coils because of the simplification of controls, piping, and housekeeping chores such as defrosting and draining oil. Bottom feed is usually best for coil efficiency unless the reduction in charge possible with top feed is more important for practical or economic reasons.

Use of a common circulating system for process evaporators such as shell-and-tube exchangers, baudelot coolers and ice cream freezers does not have much promise, because there would be no advantage in heat transfer and regulation of the process would still require just as many controls as used on unit evaporators.

It is hoped that the method proposed here of estimating the proper circulating head for coils will be tried out in laboratories by other experimentors and evaluated in terms of field experience.

Refinement of this technique would require developing two phase flow correlations in terms of an accelerating vapor and liquid. If this method proves valid, it should aid in the proper installation and operating of ammonia coils.

Table III — Test Results For Prime Surface Air Cooler With 732 Sq. Ft. and Different Method of Feeds

System Feed	Approx. Ratio Circulation Evaporated	Unit Heat Load Btu/Ft.² h	Heat Transfer Refrig. Side Btu/Ft.² h°F	Coefficient Overall Btu/Ft.² h°F
TX Valve, top	1	129	8.0	3.5
TX Valve, bottom	1	140	21.1	5.25
LP Pump, top	2.75	137	35.3	5.36
LP Pump, bottom	2.90	137	76.3	5.81

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Ammonia Liquid Return Systems, W. F. Stoecker, Industrial Refrigeration V129 n6, Dec. 1955, Page 13-20

Improving Refrigeration Systems by Applying Established Principles, J. E. Watkins, Industrial Refrigeration V130 n6, June 1956, Page 29-31, 34, 36-7, 56

Ammonia Circulation Without Pumps, P. S. Maksimov, abstracted from International Institute of Refrigeration paper in The Journal of Refrigeration, Nov.-Dec., 1958, Page 166, 167

A Pump Circulation System of Small Ammonia Capacity Having Downward Feed of Liquid, M. Filinov, abstracted from International Institute of Refrigeration paper in The Journal of Refrigeration, Nov.-Dec., 1958, Page 167, 168

APPENDIX

Pressure gradient in evaporator[5]:

The formula for calculating pressure drop per 100 feet of tube for vapor flow, assuming all subcooled liquid entering and all vapor leaving, is:

$$\Delta P_{100} = .403\ V\ f\ w^2\ /d^5 \quad \text{(p.s.i./100 ft)}$$

where V = specific volume vapor, cu. ft/lb

f = friction factor (usually between .04 and .015 for turbulent flow)

w = flow, lbs/min.

d = tube inside diameter, inches

When bottom feed traps liquid in the tube, the vapor velocity increases. Assuming the vapor evolves at the exit velocity throughout the circuit, the formula for pressure drop for the vapor flow is:

$$\Delta P_{100} = 1.21\ V\ f\ w^2\ /\ d^5 \quad \text{(p.s.i./100 ft.)}$$

Two phase correlation[2]

When extra liquid flows with the vapor, the correlation by Martinelli is:

$$\Delta P \text{ total}/100 \text{ ft.} = \Phi^2 \quad (\Delta P \text{ vapor}/100 \text{ ft})$$

where Φ = is a parameter based on experiments with different liquid fractions at different velocities (Table IV).

Table IV — Values Of Φ For Turbulent Flow Of Vapor And Liquid

R	X	Φ	Φ^2
.50	8.0	16.	156
.40	4.0	10.	100
.30	2.0	6.5	42
.20	0.8	4.	16
.10	0.23	2.5	6
.05	0.08	1.8	3

Where, R is the liquid fraction in the coil, and X is a parameter based on an expression which is the square root of the relative pressure gradients of liquid and vapor.

Good Humor Expands

▶▶ COMPLETING its third new facility in the past six months, Good Humor Co. of California announced a $300,000.00 branch installation in San Gabriel. O. Richard Capen, president, said that the new facility will employ approximately 80 people and have an annual payroll of one-third million dollars. Storage capacity at the branch is adequate for 1½ million *Good Humor* bars and will service 60-odd sales cars. Manager of the San Gabriel branch is Carl Schultz, according to the L. A. Times.

The firm completed another $300,000 branch installation in Van Nuys in January, which employs approximately the same number of personnel, has about equal storage capacity as the San Gabriel plant and services an equal number of sales fleet. The manager there is Kester Davis. San Gabriel is the seventh and Van Nuys the sixth Good Humor branch. Others are located in Hollywood, Alhambra, South Los Angeles, San Diego and Long Beach.

Arden Plant For Columbia Basin

▶▶ MOSES LAKE AREA in the Columbia River Basin is the site of a new milk plant planned by the Arden Farms Co. Roy E. Campbell, managing director, related to the Associated Press recently that property had been acquired and the plant should be completed this Fall. He indicated that Arden believed the Columbia River Basin area can become a major milk producer and that the dairy industry will play an important part in its economic foundation.

PATENT MILK CONCENTRATING PROCESS

DISADVANTAGES of a number of frozen milk concentrates produced experimentally to date has been the off-flavor and instability of the product when reconstituted. In other words, the concentrate product, somewhat like forms of powdered milk, had a scorched taste and the solid separated from the water with which the product was re-mixed.

Described at a Heat Transfer Conference sponsored by the American Society of Mechanical Engineers and American Institute of Chemical Engineers late in the summer 1958, was a new process for freezing and storing milk. Jesse F. Keville, Jr., addressed the meeting and described a patent which he had pending. The patent was granted with 7 claims in November 1958 and received its first publicity early this year.

Both off-flavor and separation are claimed to be overcome by the inventor in his process of concentrating milk and milk products. Essentially, his patent is a process of preparing frozen concentrated milk which may be stored for as long as a year without affecting flavor.

According to the patent description, the serious disadvantage of flocculation on defrosting is overcome. The process method patented overcomes the tendency in stored concentrated milk to lose casein stability.

Temperature Control Is Key

Chief object of the process invention, according to Keville, is to permit the concentrate to be maintained in freezer storage for extended periods of time. A further object of the process patented, is to provide a method of concentrating milk and milk products in a falling film evaporator at a range of 110 to 150 F, the heating medium having a temperature not greater than 180 F. Temperatures, according to the inventor, outside the range of 110 to 150 F., are detrimental to the final product.

Keville's patent, No. 2,860,988 relates in addition to the objectives already stated, other steps in the process such as cooling the concentrate, packaging the concentrate and placing the concentrate in storage. His process is assigned to Carrier Corp.

Steady Storage Conditions

According to the patent literature the packaged concentrate in storage is maintained at a temperature no greater than 10 F. There should be no substantial fluctuation in temperature for the entire storage time.

Pasteurization and/or homogenization of the milk and milk products may be accomplished prior to or after the step of concentration. Figures 1 and 2 illustrate a preferred embodiment of the process invention, the first figure detailing a preferred flow diagram and the second a modified process of the first.

Refrigerating Steps

Refrigeration involved in the process starts, of course, with the receiving of the raw whole milk. In his description Keville indicates that the milk is to be held in 40 F storage at the processing plant, with slow speed agitation to keep butter fat well mixed.

After leaving the second standardization step or the concentration, the product flows to a flash cooler when it is cooled rapidly to approximately 35 F, and then further cooled in a slush freezer to about 25 F. Following packaging, the product is tunnel frozen a few degrees below the desired final storage temperature which could be as low as minus 20 F or as high as 10 F.

Composition Specified and Process Steps Detailed

In the patent description, the inventor describes in detail the typical product composition with regard to butter fat content and non-fat solids. The pasteurizing step is detailed as to type of unit, degrees Fahrenheit and number of seconds involved. The process also describes homogenizer pressures in a 2-stage arrangement

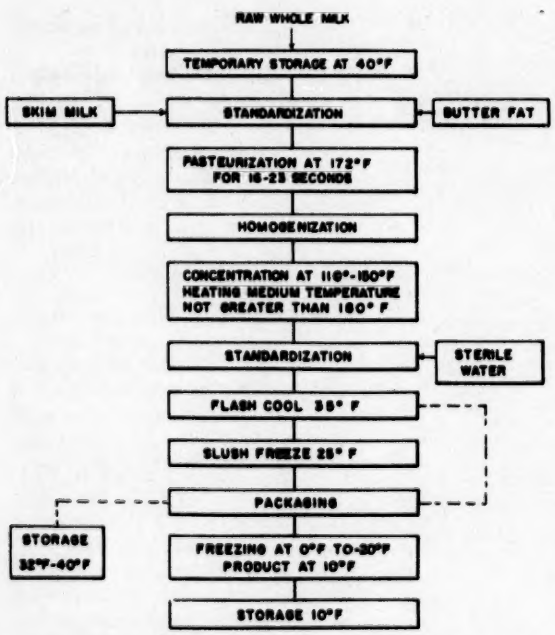

Fig. 1—Diagrammatic view or flow diagram of the Keville process for concentrating milk and whole milk products.

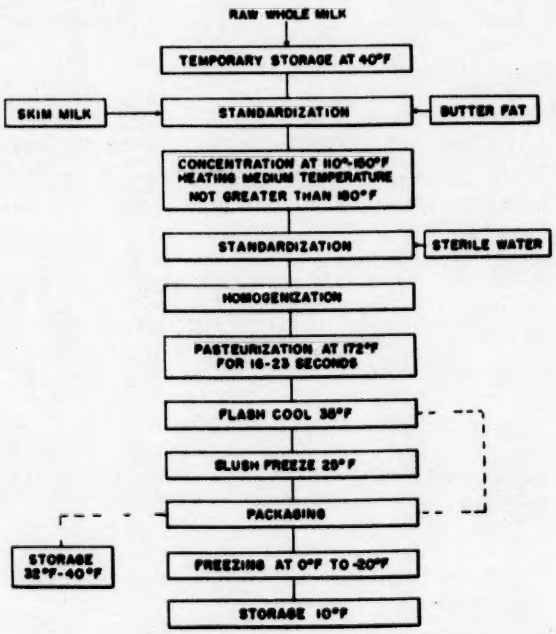

Fig. 2—A modified process which embodies pasteurization after concentration, standardization, homogenization.

Preparation Permits Long Term Freezer Storage Obviates Customary Flavor, Stability Losses

which breaks up the fat particles to an average size of two microns.

The falling film concentrator is also described, giving the vacuum range and indicating either saturated steam or hot water as a heating medium. The concentrator pumping and time factors are also given, together with a description of two controllers.

Two Final Concentrations

Final concentration of the product may be established at any desired point, according to the inventor, up to approximately 43.5% total solids content. That figure corresponds to a 4-to-1 concentration by volume based on 12.2% total solids in the initial feed milk.

If desired, the patented development reads, the product may be concentrated to about 34% total solids content, which corresponds to about 3-to-1 by volume. In these cases, three volumes of water, or two volumes of water may be added, respectively, to arrive at the exact composition obtained after the first standardization of the milk.

Describing the slush freezer, the inventor describes it as one in which the concentrate is kept from freezing on the wall by moving scraper blades. It is essential, he relates, that the concentration be quickly cooled. Any other suitable means of cooling may be employed.

Freezing and Storage

Conventional canning or packaging machines may be used, but preferably the container is a 6-oz. can. Reasoning behind the use of the small package is that the material is frozen more quickly in the freezing tunnel.

In the process description, the author emphasized that the storage temperature should not fluctuate more than 5 degrees F, if maximum product quality is to be obtained. The concentrate prepared as described has a storage life as great as one year, but the inventor believes that continuous processing can materially increase the storage life beyond one year. An advantage of the invention lies in the fact that the concentrate may be stored at a temperature as high as 10 F which would greatly reduce refrigeration costs required with lower temperature storage.

Reconstituting

To reconstitute, the concentrate is removed from storage and rapidly thawed by immersing in hot water. Rapid thawing is preferred since slow thawing may effect the thickening of the concentration so that it would be difficult to dissolve in the water required for reconstitution.

Cooler Storage Variation

Under some circumstances, the inventor also claims in his patented process, it may be desirable to take the concentrate directly to packaging from the flash cooling stage. This would permit storage at refrigerated temperatures within the range of 32 to 40 F. This unfrozen storage would give the concentrate a shelf life of about two weeks. Patent literature also indicates that concentrated chocolate skim milk or chocolate whole milk can be achieved by flavoring before or after the concentration step.

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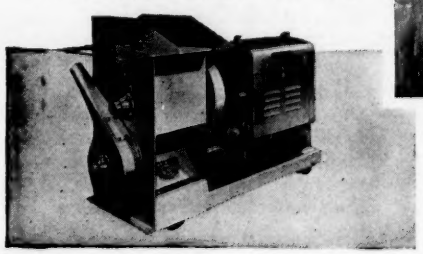

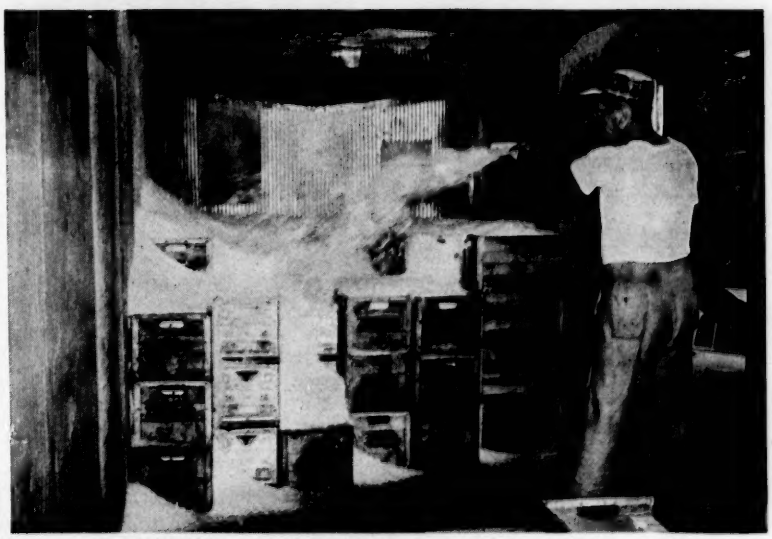

DAIRY PRODUCTS and other perishables remain cool and fresh in warehouse or en route to market under a uniform blanket of crushed ice.

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NARW HAD BEST SAFETY YEAR

▶▶PRELIMINARY FIGURES related by A. R. Carstensen, Chairman, National Association of Refrigerated Warehouses' Safety Committee, at their Annual Meeting in April, indicated that 1958 is going to be their finest year. In round figures, reports stand at 25⅓ lost time accidents. This is the lowest NARW has ever experienced. Members had 29½ lost time accidents for every one million hours worked in 1957. They have brought this down from 39½ lost time accidents in 1950!

TABLE I — NARW SAFETY AWARD WINNERS, 1958

6 years

BEALL REFRIGERATING CO.
Santa Clara, Calif.

NAT'L ICE & COLD STGE.
Stockton, Calif.

POLAR COLD STORAGE CO.
Sioux Falls, S. Dak.

5 years

U. S. SECURITY WAREHOUSE, INC.
Columbus, Georgia

4 years

AMERICAN ICE & COLD STGE. CO. INC.
Everett, Washington

EASTERN MARKET COLD STGE. CO.
Detroit, Michigan

LYNDONVILLE ICE & COLD STGE. CO.
Lyndonville, N.Y.

MADISON COUNTY COLD STGE. CO. INC.
Canastota, N.Y.

3 years

ARCTIC ICE & COLD STGE. CO.
Buffalo, N.Y.

LANCASTER ICE MFG. CO.
Lancaster, Penna.

MODERN FREEZING & STGE. INC.
Corvallis, Oregon

NEWFANE STGE. CORP.
Newfane, N.Y.

UNION ICE & STGE. CO.
San Jose, Calif.

2 years

ARCTIC COLD STGE. CO.
Philadelphia, Penna.

CARLISLE HYGIENIC C. S. CO.
Carlisle, Penna.

COMMERCIAL STGE. CO.
Memphis, Tenn.

CROSBY COLD STGE. CO. INC.
Olean, N.Y.

JAX ICE & COLD STGE. CO.
Jacksonville, Fla.

KLAMATH ICE & STGE. CO.
Klamath Falls, Ore.

LITTLE ROCK COLD STGE. CO.
Little Rock, Ark.

OSHKOSH STGE. CO.,
Oshkosh, Wisc.

PATTERSON COLD STORAGE
Jacksonville, Fla.

RUDNICK & MEAGHER COLD STGE.
Worcester, Mass.

SCOTTSBLUFF ICE & STGE. CO.
Scottsbluff, Nebr.

1 year

ANDREWS COLD STGE. CO. INC.
Prosser, Wash.

THE ARCTIC CO.
Spokane, Wash.

ARCTIC ICE COMPANY, INC.
Plant City, Fla.

ARTIFICIAL ICE CO.
South Bend, Ind.

BACU COLD STGE. INC.
Poughkeepsie, N.Y.

BURBANK REFRIGERATING CO.
Burbank, Calif.

CENTRAL WAREHOUSE CO.
St. Paul, Minn.

DIAMOND ICE & COAL CO.
Charleston, W. Va.

WILLIAM F. ENDRESS, INC.
Jamestown, N. Y.

FORT GREENE COLD STGE. CO. INC.
Brooklyn, N.Y.

GOLDEN RIDGE ORC'DS C. S.
Milton, N.Y.

HADDON ICE & COAL CO.
Haddonfield, N. J.

HAWAIIAN COLD STGE. CO.
Honolulu, Hawaii

HOUSTON TERM'L WHSE & C.S.Co.
Houston, Texas.

KOHRS COLD STGE. CO.
Davenport, Iowa

MERCHANTS COLD STGE. CO.
Fort Worth, Texas

THE MOWERY COLD STORAGE
Mechanicsburg, Penna.

NAT'L ICE & COLD STGE CO.
Petaluma, Calif.

NAT'L ICE & COLD STGE. CO.
Santa Rosa, Calif.

NORTHERN C. S. & WHSE. CO.
Duluth, Minn.

OAK RIDGE COLD STGE. INC.
Oak Ridge, Tenn.

SHARON COAL & ICE CO.
Sharon, Penna.

TERMINAL C. S. & ICE CO.
Dayton, Ohio

TERMINAL ICE & C. S. CO.
Nampa, Idaho

TERMINAL ICE & C. S. CO.
Portland, Ore.

TERMINAL ICE & C. S. CO.
Salem, Ore.

TERMINAL ICE & C. S. CO.
Woodburn, Ore.

U. S. COLD STGE. CORP.
Detroit, Mich.

U. S. COLD STGE. CORP.
Fort Worth, Texas.

UTAH ICE & STGE. CO.
Salt Lake City, Utah

WEST MICH. DOCK & MKT. CORP.
Muskegon, Mich.

WESTERN REFRIGERATION CO.
Aurora, Mo.

WESTERN REFRIGERATION CO.
Monett, Mo.

YORK COLD STORAGE CO.
York, Nebr.

On severity tabulations, refrigerated warehouses show even far better results. In 1957 they lost 896 days for every one million hours worked In 1958 it stands at 367 days!

Saddest year for NARW was 1952 when there was 1,840 days lost per one million hours worked. Although a few reports were yet to come in at the time of Carstensen's report, NARW had a severity record to be proud of also. He congratulated the members, stated that they were responsible for this record, and thanked all for their cooperation and help in the Association's safety movement.

Newest Effort An Accident Analysis Service

Receiving considerable attention at the NARW meeting was a new Accident Analysis Service announced in December by Carstensen. The new safety service designed to help warehousemen prevent accidents will consist of a four-page bulletin circulated to members, in which an accident occurring to a member is described. No company names are used in the description of the accident but the second part of the report will itemize the damage. The third and fourth parts will deal with preventive measures, one listing those measures suggested by the member plant experiencing the accident, and the other preventive measures suggested by the Safety Committee. All members are invited to comment on the bulletin and subsequent issues will be circulated as improved preventive measures are suggested.

Committee Prepared Two Analysis Reports

Preventive measures suggested by Clyde E. Gross, chief engineer, California Ice & Cold Storage Co., Long Beach, Calif. to the NARW Accident Analysis No. 1, issued on December 10, was published by the Association's Safety Committee in March. The analysis described an accident which resulted when a refrigerated truck using an ammonia line hook-up pulled away without first disengaging the ammonia connections.

Gross pictured and described how the truck ignition circuit is dis-connected through a switch on the refrigeration service door. The door cannot be closed until the refrigerant lines are disconnected, thereby rendering the truck ignition inoperative.

(See Figure Top of Page 20)

MAY—Bought anhydrous ammonia after supplier's claim of dependable delivery . . . 1st shipment on time.

LATER—2nd ammonia shipment late . . . receiver almost empty . . . head pressure and efficiency dropping.

STILL LATER—Receiver empty . . . found compressors short-cycling and working overtime . . . power and water costs up.

TOO LATE—Still no ammonia! Cold room shut down, had to move perishables . . . operating costs up and profits down.

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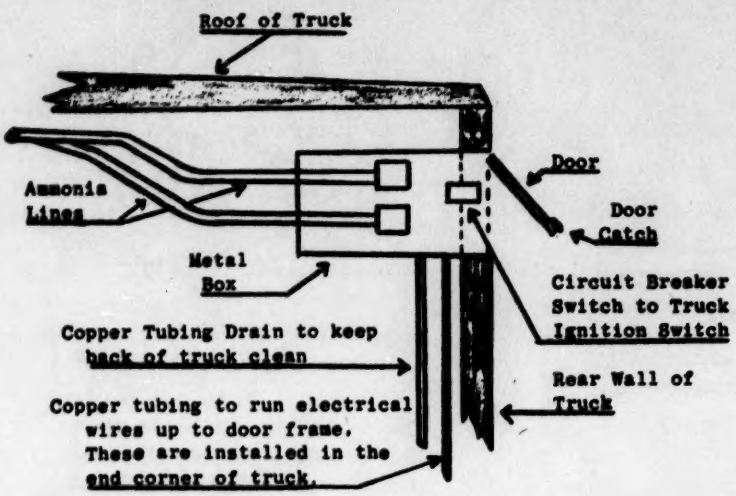
NARW Safety Program (Continued)


Roof of Truck
Door
Ammonia Lines
Door Catch
Metal Box
Circuit Breaker Switch to Truck Ignition Switch
Copper Tubing Drain to keep back of truck clean
Rear Wall of Truck
Copper tubing to run electrical wires up to door frame. These are installed in the end corner of truck.

Contributed by a California engineer, this hook-up is offered NARW as a solution to accidental disconnect of truck refrigerant service lines.

Analysis No. 2 describes how a fire started at the terminal block of the battery cable and the charging line on a fork lift truck. The fire was fought with a soda acid extinguisher, thereby contributing to the damage. For a Class C electrical fire, dry chemical or carbon dioxide extinguishers are the proper fire fighting tools.

Safety Award Winners

Winners of NARW Safety Awards for the year ending December 1958 are given in Table I, page 18.

In 1959, NARW is going to add an additional Safety award. It is being brought out to give recognition to the larger plants that might not go a full year without a lost time accident, but still worked a large number of hours without an accident. It is awarded on a basis of every 250,000 hours worked without a lost time accident. First new award winner, announced in NARW COLD FACTS for April 1958, is the Alabama State Docks Cold Storage Plant, Mobile. Superintendent John V. Grubbs announced the plant completed 1958 without a single lost time accident.

Cites Detroit Firm

This award as well as the yearly one presently being issued, could actually both be given to the same company. The period covered will commence from the time of a firm's last lost time accident and can be awarded on the basis of an entire company's operation at one plant, or by departments of one plant.

In looking over the 1958 reports, Carstensen remarked, he noted that the U.S. Cold Storage Corp. plant at Detroit qualified as they went over 250,000 hrs. in one year. As another example, he cited his own company which would also qualify, but it took them 2½ years to reach 250,000 hrs.

Carstensen, president of Crystal Ice & Cold Storage, Sacramento, California, recently presented a 35-year safety record award to one employee, along with 20 other awards. Fifteen of those 21 employees had never had a lost time accident.

Dairy Safety Gains

Stated another way, this illustration represents one day's profits down the drain. —*Courtesy National Safety Council Associations' News Letter.*

▶▶CONSIDERED in the forefront of managerial responsibilities among executives of the dairy industry, is safety. M. J. Van Buskirk executive secretary, Illinois Dairy Products Association, Inc., made this statement in the National Safety Council ASSOCIATION'S NEWS LETTER, May-June 1959 issue. Interest of the dairy industry is two-fold. The application not only includes their workers but the public as well. This attitude has been emphasized through the Milk Industry Foundation's many safety projects.

Small Business Challenged To Do Its Part In Safety

The attitude of many executives has changed in recent years from the viewpoint that safety programs were the responsibility at plant level rather than top management, Mr. Van Buskirk wrote. He also pointed out that managers of small businesses are beginning to realize that accident costs of the industry are not only the responsibility of a few larger organizations, but of every unit. The fact that state legislators and law enforcement authorities are considering safety on an industry wide basis, just as insurance writers do when setting rate classifications, should promote more safety consciousness on the part of the small, as well as the large operator.

There is a definite economic aspect in safety. One association pointed out recently that it saved its members over $600,000 in workmen's compensation in their insurance last year by means of a safety program, according to Van Buskirk.

Tests Frozen Baby Foods

▶▶BIRDSEYE DIVISION, General Foods Corp., is test marketing a new line of Frozen Baby Foods in Watertown, N. Y. supermarkets. The JOURNAL OF COMMERCE, describes the new line as being produced by a "dry-freezing" process. Product has been tested for the past two years by three university research centers and is reported as possessing many advantages over other types.

Dairying Gains In '59

▶▶LARGEST GAINS in income during the first month of the fiscal year 1959 for City Products Corp. were in the dairy and oil divisions, according to William J. Sinek, chairman. The CHICAGO DAILY NEWS quoted Sinek as saying that earning prospects for the current fiscal year are excellent and show a substantial gain over the previous fiscal year. Sales year for the firm ended March 31.

Dairy Growth Abroad

▶▶CONSTRUCTION, expansion, mergers and the like which take place in the United States in the milk and ice cream industry have their counterparts abroad. Announced early in the year in FINANCIAL TIMES, London, were plans by T. Wall & Sons to erect at Gloucester, a plant which they claim will be the world's most modern ice cream factory. Work is under way and production is expected in 1960. Building of the factory, said a company spokesman, has become necessary owing to the steady increase in the demand for ice cream all-year-round.

The main plant at the Gloucester site, which consists of nearly 30 acres, will have a ground floor where ice cream ingredients will be kept under ideal refrigerated conditions, with mixing tanks, engine room and personnel facilities housed in separate areas on the same floor. A top floor will house stainless steel production lines where as many as ten different types of ice cream will be produced simultaneously at a rate of about 45,000 gallons daily per shift.

The processing plant and its refrigerated equipment will be as fully automatic as is consistent with efficient operation, said the Wall management. There will be a cold store, wafer factory, a cabinet repair shop, and a transport garage and repair facility. From 650 to 1000 persons will be employed.

Canadian Expansion

Canadian subsidiary of the Borden Co. earlier in the year announced construction of a $1 million dollar milk plant at Montreal, and expansion of ice cream manufacture at Belmont, Ontario, and fluid milk and ice cream operations at London, Ontario. Increased sales and earnings of the company, plus the fact that Borden celebrates its 60th anniversary of establishment in Canada this year, prompted the expansion steps.

Also effected during the year is a merger of the Company's cheese and manufactured products divisions into a new food products division, and addition to the fleet of electrically refrigerated milk trucks.

African Milk Interests

Kenya Co-operative Creameries, Ltd., early in the year took over Dalgety and Company, Limited, who had pioneered a market in Uganda. The new company in Kampala, called Uganda Creameries, Ltd. is successfully marketing 60,000 gallons of milk per day and nearly 70 tons of butter per month. A native, S. M. Kulubwa, became the first African elected to the board of the KCC. Long-term development plans of the company include additional pasteurization and packaging equipment, plus a fleet of refrigerated road trucks which will distribute butter, cheese and ghee in outlying areas.

Ammonia Not Responsible In Chicago Dairy Blast

▶▶NITROUS OXIDE was the gas stored in a pressure system at a Northwest-side dairy products plant in Chicago which was reported in a blast in the Sunday papers on May 24. Refrigerant was not responsible for the explosion according to Fire Chief Edward Newell, 6th Division, who estimated damage at $100,000.

Aerating Gas Tank Failure

Nitrous oxide is used for aerating whipping cream. In the Chicago dairy plant it was stored in a 42-in diameter by 7 ft high pressure vessel at 300 psi. It is alleged that the vessel safety valve failed. Five persons injured included one employee and four persons either employed or on the premises of adjacent business enterprises.

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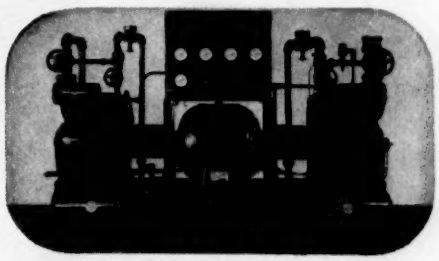
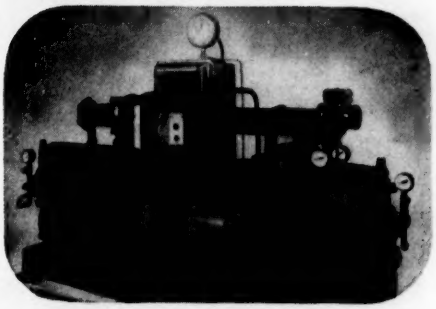


CP TYPE K AMMONIA 2-STAGE COMPACT ASSEMBLED UNIT 4 cyl. 5 x 3½ Booster with 4 cyl. 3½ x 3½ High Stage Compressor direct connected to a 1160 rpm. 60 H.P. motor. Temperature range —25° F to —55° F; 23.3 to 9.4 tons refrigeration; 54.2 to 36.3 brake H.P.; CAPACITY EQUAL TO 9 x 9, 2-CYLINDER VERTICAL COMPRESSOR @ 330 RPM OPERATING SINGLE-STAGE WITH 75 TO 100 HORSEPOWER MOTOR.



CP TYPE VS6-2 AMMONIA 2-STAGE COMPACT ASSEMBLED UNIT 6 cyl. 2½ x 2 Booster with 2 cyl. 2¼ x 2 High Stage Compressor direct connected to a 1760 rpm. 20 H.P. motor. Temperature range —25° F to —55° F; 8.33 to 3.35 tons refrigeration; 21.5 to 14.60 brake H.P.; CAPACITY EQUAL TO 7 x 7, 2-CYLINDER VERTICAL COMPRESSOR @ 280 RPM OPERATING SINGLE-STAGE WITH 30 HORSEPOWER MOTOR.

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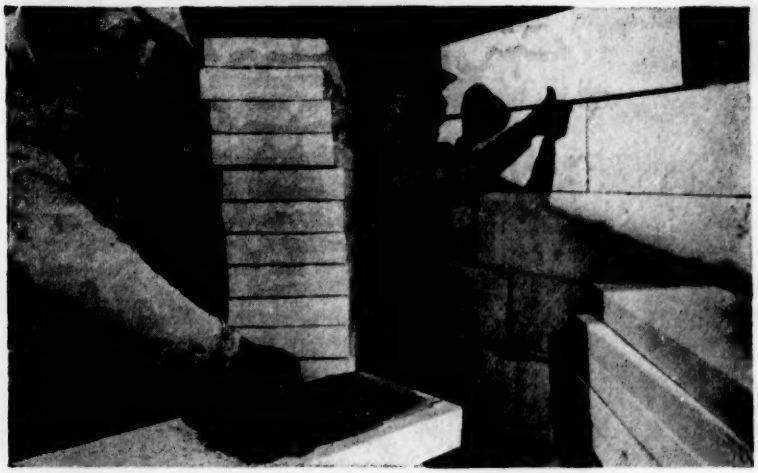

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NAPRE QUESTION BOX

HAVE A QUESTION? Address it to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif. Answers appear monthly in this department on problems forwarded by NAPRE members. Comments from all readers welcomed.

H. P. Hayes

Water Contamination In Cascade Refrigeration Plant

QUESTION: Moisture is a problem in a cascade refrigerating system at our aircraft plant. Refrigerant 13 is condensed by Refrigerant 22 in the system employed, and the moisture is not in the Refrigerant 22 cycle where it might be expected, but in the Refrigerant 13.

We have 11 chambers in one building and several other chambers in outlying buildings. However, the problem has to do with the chamber in the missile building where the evaporators are of a new design.

The new design in the missile building chamber differs from our old systems in this way: In our older chambers the Refrigerant 22 cycle does all the cooling above 32F. Below 32F, the Refrigerant 13 cycle does the refrigerating, with Refrigerant 22 then becoming the condensing system for the Refrigerant 13.

Refrigerant Employed Thru 330 F. Range

On the new design, Refrigerant 13 is the coolant in a range from 230F to minus 100F. During this entire cooling cycle, the Refrigerant 22 does nothing more than condense the Refrigerant 13.

As much as a gallon of water is found to be getting into the new system after each test is completed. One environmental test had to be abandoned after the cooling cycle had started because of a frozen coil. Similar tests were repeated over and over again in older design chambers with no such moisture problem.

Dry Gas Received

Our first reaction was that we were receiving some contaminated shipments of Refrigerant 13. A check with the distributor and the manufacturer proved that the rigorous routine was assuring delivery of absolute pure gas to our plant. New driers were used every time we charged the chambers and the system thoroughly dehydrated before charging. Every possible precaution was taken to see that excessive moisture did not enter the system when charging or making repairs.

Other Leak Suspicions

The same make and type of compressor was used on both the Refrigerant 22 and Refrigerant 13 systems, for both the older and newer design of environmental chamber compression systems. Jackets of compressors are water cooled with pressure at 50 psig. Also, the Refrigerant 13 liquid passes through a heat exchanger with the same water supply being used at 50 psi.

We thought of a possibility of raw water getting into the liquid through a leak in this heat exchanger but cannot see how this would be possible with a Refrigerant 13 highside pressure of 150 psi. However, on the low side the Refrigerant 13 system operates almost always under a vacuum during the final stages of an environmental chamber pull down. Where would you suggest we look for the water entrainment?

—A.E.C., Los Angeles.

ANSWER No. 1: It is probably a combination of two factors which causes the water to form in the Refrigerant 13 stage. They are: (1) the leakage of air into the system when the low stage is operating at a vacuum and (2) the oxidation of the lubricating oil, in the presence of air, into carbon dioxide and water.

Most shaft seals operate satisfactorily as long as the crankcase pressure is greater than that of the atmosphere, but soon fail when the crankcase is operating at a vacuum. Sealing is accomplished by a thin oil film between the two polished surfaces of the shaft seal. The oil film is normally maintained by an infinitesimal leakage of oil from the crankcase toward the outside. When the crankcase pressure is below that of the atmosphere the oil film will normally not be maintained more than a half-hour with consequent roughening of the seal and leakage of air into the system.

Oil Oxidation Makes Water

Of course this air leakage will not directly account for the large amount of water in the system, but indirectly considerable water may be formed by the oxidation of the lubricating oil. Air comprises approximately 80 percent nitrogen and 20 percent oxygen. This oxygen will combine with the oil at the discharge temperature of the system forming carbon-dioxide and water.

If it is possible to use a low pressure cut-out on the Refrigerant 13 system set at atmospheric pressure this may solve your problem. At this pressure the evaporating temperature of the refrigerant will be about minus 115F. If this is not feasible, the crankcase of the compressor should be pressurized. This may be done by closing any ports in the compressor between the crankcase and the suction vapor, and running a small line from the discharge through a pressure reducing valve to the crankcase. The crankcase should be pressurized to only a few psi above that of the atmosphere.—N.S., Cal Poly.

Heat Exchanger Was Water Entrainment Source

ANSWER No. 2: Since receiving Answer No. 1, we have come upon two other causes for the water in the Refrigerant 13 system. The test chambers were fabricated in another plant and delivered to our own. Unfortunately we were not able to observe their manufacturing methods and examine all the components used in the refrigeration system.

One of these components is the shell and coil heat exchanger which is used as a desuperheater on a hot gas line. Fresh untreated water is used in this heat exchanger. The cooling water is controlled by a solenoid valve in series with the motor.

When we suspected this component, we shut the compressor down and closed the discharge valve. We connected a drum of dry nitrogen to the heat exchanger and when a pressure of 215 psig was reached a leak was found in the coil.

This alone would have convinced us that we had found the leak, but we found that the water solenoid also leaked when in a closed position indicating another cause of our trouble. Our maintenance force proved the desuperheater as the source of trouble by removing it and running a dehumidifying test on the balance of the system. Once dried out we couldn't find another trace of moisture in the system.

Shaft Seals Were Replaced

Further to **Answer No. 1:** practically the first thing that had to be done with the compressors was to remove the shaft seals provided by the manufacturer, and to replace them with a seal manufactured locally. We have experienced no trouble with leaking of shaft seals since, although to reach a temperature of minus 125F we have had to run the machines below atmospheric pressure.

—A.E.C., Los Angeles.

Ammonia Safety Data

QUESTION: Where can literature be found on ammonia systems exploding, etc., and what the probable causes were? Also, do you have anything on the safety features that should be installed in a refrigerated warehouse and its system, where ammonia is used as the refrigerant?

—A.G., Okinawa.

ANSWER: Requested by Prof. J. M. McGrath, Co-ordinator of the Question Box, to comment on ammonia safety, R. S. Passmore, Mgr., Armour Ammonia Division offered:

"We are not familiar with any complete literature in this field, although we suggest that the reader refer to the Underwriters' Laboratories' report on THE COMPARATIVE LIFE, FIRE AND EXPLOSION HAZARDS OF COMMON REFRIGERANTS, their publication on Miscellaneous Hazard #2375, dated November 13, 1933.

"The Underwriters' Laboratories, which was established and maintained by the National Board of Fire Underwriters, investigated the hazardous characteristics of a number of then used refrigerants. Of particular interest is this and other studies on the flammable limits of anhydrous ammonia. When mixed with air there apparently is a hazard when the percentage of ammonia vapor is between 16 and 25 percent.

"There is also a bulletin issued by the Manufacturing Chemists' Association which may be of interest in this connection: Item 3, Table I, Pg. 26.

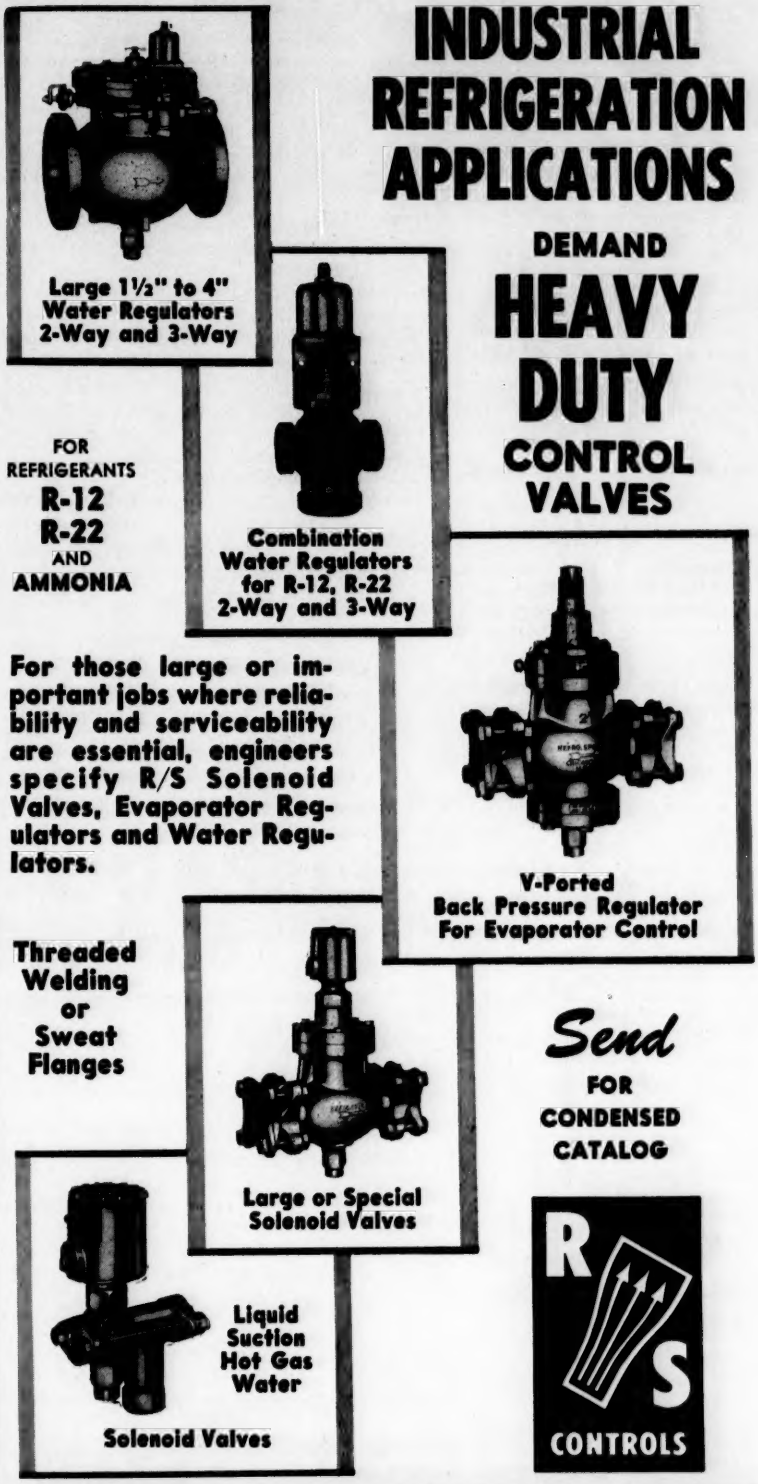
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TABLE I – SOURCES OF NH_3 LITERATURE – SAFETY FEATURES

Literature or Reprint	Source of Distribution	Cost
LIMITS OF FLAMMABILITY OF GASES AND VAPORS H. F. Coward & G. W. Jones Bull. 503, Bu Mines, 1952	Supt. of Documents U.S. Gov't Prtg. Off. Washington 25, D.C.	40¢
COMPARATIVE LIFE, FIRE AND EXPLOSION HAZARDS OF COMMON REFRIGERANTS Misc. Hazard #2375 Nov. 13, 1933	Underwriters' Laboratories 207 E. Ohio Chicago 11, Ill.	Not Given
Chem. Safety Data Sheet SD-8 PROP. & ESSENTIAL INFO. FOR SAFE HANDLING & USE OF ANHYDROUS AMMONIA, Rev'd 1952	Mfg. Chemists Assn. 1625 Eye Street, N.W. Washington 6, D.C.	30¢
FLAMMABILITY LIMITS OF AMMONIA & AIR MIXTURES (Spencer Chem. Co. Tech. Proj. #55-28)	Compressed Gas Assoc. 11 W. 42nd St. New York 36, N.Y. (To be released only on consent of Spencer Chem. Co., Vicksburg, Miss.)	Not Given
ANHYDROUS AMMONIA SAFETY Safety Check List For Bulk Storage Paul W. Tucker & A. F. Dyer AGRICULTURAL AMMONIA NEWS Agricultural Ammonia Institute	Acme Protection Equipment Co. 1201-99 Kalamazoo St. South Haven, Mich.	No Charge
SAFETY BULLETINS, NARW Disaster In the Plant, 4/9/58 Disaster, 4/10/58 Handling of Refrigerant Cylinders, 11/13/57	National Association of Refrigerated Warehouses Tower Bldg. Washington 5, D.C.	N.C. to members Nominal reprod. & mail. chge to non-members
TENTATIVE STANDARDS FOR AMMONIA CONDENSERS AND RECEIVERS 4-51 Ammonia Evaporative Condenser Units 4-52 Construction of Ammonia Condensers, Vertical Open Shell-and-Tube Type 4-54 Construction of Ammonia Condensers Horizontal Closed Shell-and-Tube Type 4-55 Performance of Ammonia Condensers Horizontal Closed Shell-and-Tube Type 4-56 Ammonia Liquid Receivers	Air Conditioning & Refrigeration Institute 1346 Connecticut Av. N.W. Washington 6, D.C.	$1.00
STANDARDS FOR AMMONIA COMPRESSORS AND CONDENSING UNITS 5-12 Enclosed Ammonia Compressors Vertical Single-Acting Type 5-14 Standard Equipment for Ammonia Condensing Units 5-15 High-Speed Ammonia Compressors	Air Conditioning & Refrigeration Institute 1346 Connecticut Av. N.W. Washington 6, D.C.	50¢
AMERICAN STANDARD SAFETY CODE FOR MECH. REFRGN. (1958) ASA B9.1–1958 ASRE Standard 15-58	American Society of Heating Refrigerating & Air Conditioning Engineers 234–Fifth Ave. New York 1, N.Y.	$1.00
HOW DANGEROUS IS AMMONIA? K. M. Holaday Reprinted from Industrial Refrigeration, May 1958	Reader Service Dept. Nickerson & Collins 433 N. Waller Av. Chicago 44, Ill.	50¢
SURVING AND PREVENTING DISASTERS Reprinted from Industrial Refrigeration, July 1958	Reader Service Dept. Nickerson & Collins 433 N. Waller Av. Chicago 44, Ill.	50¢

"We have, of course, read numerous accident reports in which ammonia became involved principally because there happened to be an ammonia refrigerating plant in the vicinity of the accident. You are probably familiar with the explosion which occurred in Richmond, Virginia, and here was an instance where initially the blame for the explosion was placed on ammonia. A more thorough investigation indicated that the explosion could have been caused by escaping fuel gas.

Keep Contaminants Out

"Frankly, we do not know of any instance where it was proven conclusively that ammonia was the cause of an explosion. There is a possibility that ammonia vapor, heavily saturated with oil vapor, might have explosive limits other than those indicated for pure ammonia, but again we know of no instance where it was possible to directly attribute an explosion to such a mixture.

"Inasmuch as there is a great deal of conjecture about how much, if any, ammonia contributes to a plant explosion, it would be wise to make sure that every engine room in which there is ammonia equipment be thoroughly ventilated. To the extent feasible, keep clean ammonia in the system in order to keep the ammonia at the highest purity economically possible."

Suggested Reading

INDUSTRIAL REFRIGERATION has from time to time published papers on this topic. Some reprints are still available. See Table I, last two items.

As indicated by RSP, above, there is apparently no collection or extensive printed work on this subject of refrigerant safety. It has been suggested by Ken M. Holaday, a past national president, NAPRE, and Utilities Distribution Engineer, Anheuser-Busch, Inc., that NAPRE sponsor some convention speakers on the topic and subsequently gather their data and other materials into an emergency or refrigerant safety handbook.

More Safety Articles Urged

Emerson Venable, professional engineer consultant on flammables, concurred with IR late in March that a suggested three-part series of articles, reprinted in a manual as suggested by Holaday, would help the industrial refrigeration industry in its active promotion of refrigerant safety. Perhaps the safety committee of NARW, and other organizations as TRRF, MCA, AAI, ASHRAE, would interest their appropriate technical committees in publishing a series which would include:

a) Experiments and report on flammable and explosive limits of NH_3 taken from typical industrial systems (a move to dispell the dissociation of gases theory, as a contribution to explosions; and refutation or confirmation that oil in the system broadens flammable limits of the refrigerant).
b) Emergency Procedures and Personnel Safety Measures in an NH_3 refrigeration plant.
c) Emergency Procedures and Personnel Safety Measures to be observed for halocarbon gas leaks in and about large (central station) refrigeration and air conditioning plants.

—J.R.K., Chgo.

Oil Loss Experience On Brine Chill Unit

QUESTION: Picture a brine tank which is cooled by a Refrigerant 12 compressor. The coil in it is of the inundated type, and the flow of refrigerant into the coil is controlled by a thermostatic expansion valve. The compressor is located at the side of the tank (or at the same level as the coil). The suction is at the top of the coil, which is higher than the compressor, and the liquid entrance is just at the bottom of the brine tank.

The pressure at which the unit is run is, at 10 psig suction and 125 psig high pressure; keeping the brine more or less at a temperature of plus five F. My problem is that I lose the oil in the compressor. I have tested the rings and the compressor, but they are O.K.; nor have I had this experience with one compressor, but with different compressors that I have used. On the other hand I have had other tanks like it that do not lose the oil in the compressor. Will you be so kind as to tell me, what can be the cause, and how to remedy it?

—I.F.V., Monterrey, Mex.

ANSWER: It is common for most halocarbon compressors to lose oil from the crankcase when starting, after having been idle for several hours. If this lowering of the crankcase oil level is not severe, and the crankshaft still causes an oil splash, and if the oil returns to the crankcase within 15 minutes, your system may be considered normal. Some compressors have a greater tendency on starting up to lose oil from the crankcase than others.

Frequently, the operator will think that he can correct the problem by adding more oil to the compressor, only to find that he has aggravated the situation rather than helped it. If there is too much oil in the system it returns to the compressor excessively diluted with refrigerant and is easily thrown out of the crankcase whenever its pressure is lowered.

Sometimes the expansion valve is adjusted for insufficient super-heat. In such cases the oil also returns to the crankcase excessively diluted with refrigerant and the oil will be easily thrown out of the crankcase on a lowering of pressure.

Piping Hookup Often Contributes To Problem

If there is not suitable drainage from the evaporator at the location of expansion valve thermal bulb, the refrigerant-oil solution collecting at this point may cause improper action of the expansion valve with varying percentages of refrigerant in the oil returning to the crankcase, and hence an erratic oil level. If it is necessary for the suction line to lead upward after leaving the coil, a P-shaped trap, should be used.

If the expansion valve is greatly oversized it will have an off and on action with varying concentrations of refrigerant in the oil, and unstable crankcase oil level.

—Norman Sharpe, Cal Poly.

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Industrial Refrigerating Plant Safety And Accident Prevention

About The Author–

This year John H. Herzog is completing his fourteenth year as chief engineer of Burgermeister Brewing Corporation in San Francisco. An active member of NA PRE, he is past president of National Association of Power Engineers, and has been associated with that engineering organization for 33 years. His long background in engineering dates back to the Texas oil fields in the pre-World War I days; during WWI he served as a submarine test engineer.

When peace was restored, Herzog was named supervising engineer for the seven schools and hospitals under the care of the Sisters of Mercy in San Francisco. His activities in WWII included serving as electrical superintendent of the shipyards in Napa, California, where he was also engineer in charge of tests and trials.

In addition to his duties as chief engineer of one of the largest and most modern breweries in the West, Herzog has authored numerous articles on practical engineering. He is a member of the Mayor's committee on smoke prevention and air pollution in San Francisco. His paper published here was given before the NAPRE national meeting, November 1958, at Miami, Fla. He appeared on a management-training-safety forum.

▶▶▶ DISCUSSION of all the diversified problems of safety and accident prevention in power and refrigerating spaces in the short space alloted would be skimpy, indeed. Therefore remarks here pertain only to certain phases of safety connected with the engineering department. Presented, will be the case history of certain disastrous accidents which happened recently in refrigerating plants.

It has been said that practical engineers have few accidents; but, when they do . . .!! It is true that the frequency rate of accidents in power plants is very low in comparison with accidents in other departments in industry. However, **the severity and lost time rate is very high.**

Engineers Rate At Extremes

The safety committee of the National Association of Refrigerated Warehouses is doing a wonderful job in safety promotion. Their 1957 safety report states in part: "For every one million man hours worked we have eliminated one out of every four lost time accidents, and have cut the number of lost time days in half." (The 1958 report given on another page of this issue, is even more outstanding).

A breakdown of the accidents in the various departments showed that in the cold storage department there were 206 lost time accidents, 3046 man days lost. The severity was 608. In contrast, the engineering departments for the same period had only 20 lost time accidents, but 6398 man days lost, and a severity of 4876.

These statistics clearly show the necessity of a careful study of the danger and hazards connected with the operation and maintenance of the power plants, and the importance of teaching and applying safety whenever possible.

Flareback Accidents

Boiler explosions are happening very seldom today. However, furnace explosions continue to skyrocket. Natural gas is widely used as a boiler fuel. It burns completely and is very flexible. But the danger of furnace explosions due to accumulation of gas in the fire box when the boiler is idle, has caused considerable loss of life and property. The reasons are mainly insufficient purging before lighting off, carelessness, ignorance of automatic controls, and lack of sufficient stack draft.

An inexpensive way of increasing stack draft is to install a steam or air operated multistage ejector in the stack, connected through a mercury switch with a timer and burner control circuit which will double the draft and effectively evacuate any accumulation of gas from the furnace before lighting off. This draft system uses about 250 pounds of steam per hour in a 50,000 pound per hp boiler installation–and, it will also serve as a smoke eliminator when burning fuel oil. (See Table I).

Many accidents are due to burns from welding or burning hot steam and ammonia lines, pipe line failures, unsafe ladders, eye injuries resulting from not wearing goggles. Safety posters in prominent places should be changed regularly. Ammonia masks at every exit should be kept in readiness. The conventional cannister type gas mask is only good for a concentration of less than two percent. Therefore, the self-contained air pack mask is more effective in any emergency. Regular safety meetings and drills cannot be stressed enough.

Brewery Casualty

One of the most disastrous ammonia explosions took place during the night in a Canadian brewery with a physical loss of about one million dollars. After the most extensive investigation by experts in the field, this explosion was attributed to ignition of a mixture of ammonia, gas and air. Although the cause of the ignition was not known it was assumed that perhaps a broken light bulb, a defective motor, or static electricity caused a spark.

TABLE I — STEAM JET BLOWERS — RATINGS AND PRICES

No.	Pipe Size	Lbs.* air/hr. 50 psi	Price — f.o.b. Philadelphia
0	½"	100*	46.00
1	½"	183*	62.00
1½	¾"	263*	75.00
2	¾"	359*	90.00
2½	¾"	542*	141.00
3	1"	734*	175.00
3½	1"	1055*	235.00

* Divide by 4.5, to get std. cfm. Add about 10% for freight. Nozzles are #418 cast iron.

Sometime during the night in question the employees smelled ammonia fumes and while investigations were made, several violent explosions occurred which knocked down an entire brick wall within a matter of minutes, damaged tanks and 95 percent of the piping. Experts engaged by the adjusters definitely established that a mixture of ammonia vapor and air in the proportion of 16% to 25% by volume would constitute an explosive mixture, and when ignited could produce pressure to about 50 lbs. per square inch.

Although there were many expert opinions expressed in this particular explosion there were no actual eye-witnesses present, and many of the conclusions are only assumptive for possible causes of this disaster.

It is apparent that the explosive properties of ammonia are not generally recognized by many users. Many of the experiments conducted in laboratories are not conclusive and cannot produce actual conditions which could be encountered in various plants.

Rare Eye-Witness Account

Consider a recent ammonia explosion and an eye-witness account. It happened on a Monday morning at 8:30 a.m. The day shift had started its production schedule. The chief engineer was making his regular inspection through the plant when he heard a hissing sound like the blowing of a boiler safety valve. Arriving at the boiler room he found everybody had evacuated the plant and buildings on account of the ammonia fumes. He could not find any of the operating personnel at this time so he proceeded to shut off the main gas supply valve to the boilers.

It was impossible to enter the compressor room with the available cannister type gas mask. In the meantime the fire department had arrived and they supplied the chief with a self-contained air pack gas mask. He then proceeded to the compressor room to determine the break and see if anyone might still be in danger.

All of the eight ammonia compressors, three air compressors, and four CO_2 compressors were in operation. The discharge line of No. 1 ammonia compressor had sheared off at the threaded connection on the compressor. After securing the suction valve, he proceeded to shut down the machines from the nearby switch board. He succeeded in shutting down three compressors; but, after opening the circuit breaker of No. 4 compressor, a violent explosion took place which lifted the skylight roof in the 40x60 x20-ft ceiling of the compressor room. The blast knocked the chief down.

Author's Own Experience

"I do not know how long I laid unconscious, but when I revived, I noticed long bluish flames in horizontal layers of approximately one foot apart and six feet above the floor in the entire compressor room. I might state that I was somewhat uncomfortable as I viewed the situation. Then, realizing that I was still among the living, I crawled on my hands and knees to the nearest exit where I told one of the engineers to secure the discharge valve of No. 1 compressor. The situation was then under control. After three hours the whole plant was back in operation."

(Author Herzog spent the next four weeks in the hospital recuperating from 2nd and 3rd degree burns, and severe shock).

The cause of this accident might have been excessive vibrating caused by settling of foundation on account of heavy spring rains and poor soil conditions; a slug of liquid ammonia; or pipe stresses; or metal fatigue, especially in the threaded connection.

General Plans Speculative; Taylor-Make Plant Procedures

There might be all kinds of safety committees, commissions, public or state or federal agencies concerning what to do first in an emergency. First on such a list, naturally, should be to do all possible to save life—which should apply in any emergency. Next in importance is to get the plant safely back into operation as soon as possible.

In the accident just described, the main primary power could have been disconnected. But this action would have shut down all elevators, man lifts, and lights, thereby running the risk of catching someone in a tank, cellar or other dark place, who would then have had no chance of leaving the building.

The electric control system of compressors and other machinery could have been located on the outside of the building, but in the case of having to fight a possible resultant fire with water, a serious shut down could have resulted.

Hardly any two accidents are alike, and each one must be analyzed before passing any judgment.

Wants More Study Of Refrigerant Ignition Limits

This accident has affirmed the author's opinion that the combustion of a mixture of ammonia and air has not received the same degree of study as that of other combustible gases, and there is still much uncertainty in regard to certain phases of this reaction.

At the time of this accident, there were eight compressors having a 1000-TR capacity discharging at 150 psi into the compressor room. Since the entire roof was lifted, and the flames were in various layers for the full length of the room, it is believed the assumed percentage of 16 to 25 percent concentration is not correct.

In the meantime, the author has conducted experiments by cutting various ammonia pipelines with pressures of less than one-lb., and found in every case that ammonia will burn 12 to 24 inches from the cut.

Even today it is not uncommon to hear that ammonia is not explosive. This theory is expressed in an article by T. R. Hughes, Safety Engineer of the Dept. of Ind. Safety in the State of California. Mr. Hughes states that he spent more than 20 years in the Middle West and California, worked with ammonia under various conditions, and belonged to various organizations of refrigerating engineers. "None of us was aware", he writes, "that the contents of our refrigerating systems could produce explosions under certain circumstances".

However, many ammonia explosions and fires have occurred when cutting in a new connection on the suction or discharge header, and sometimes it is a leaky valve which prevents a complete pump down.

Practices, Remedies Offered

In the brewing industry there is always a considerable storage of carbon dioxide, either in a liquid or gaseous state. It could be used in clearing pipe lines of ammonia gases, oil or other non-condensables before applying the cutting torch. Carbon-dioxide also could be applied for fire fighting and dust explosions in grain silos and conveyors.

The NAPRE, in cooperation with other engineering societies, should also adopt a standard color code for power plants, and influence regulations requiring all ammonia piping two inch and larger to have welded connections. This requirement should be in effect especially where the piping joins the ammonia compressor. At this point a threaded connection would be the weakest link in the entire piping system.

Safety and maintenance problems should never be neglected. They require a constant check, and too often on account of lack of time or appropriations or plain indifference, the necessary improvements and safety measures are again and again postponed until some day the inevitable happens, a break down or an accident in that necessary evil—the power or refrigerating plant.

Booster Compressor Restores Capacity At Ice Cream Plant

Provides More Intermediate Temperature Service

▸▸ONE MAJOR PROBLEM encountered in ice cream plants, occurs when increasing production overloads the refrigeration system. If the overload is great enough, optimum low temperatures cannot be maintained and production slows down. The alternatives are to limit the flexibility of the plant by curtailing some freezing operations, or to expand the refrigeration system.

Overloading is what happened recently at Woodlawn Farm Dairy Co. Div., Foremost Dairies, Inc. in Wilkes-Barre, Pa. Production of a variety of ice cream products had increased to the point where hardening time had become excessive. To counteract this, the plant was forced to limit other processing operations in order to assure thorough hardening of packaged ice cream. As a result, it was decided that the refrigeration system should be expanded to include a third stage in the compression cycle.

Formerly, low stage or booster compressors in this plant were hooked up to handle ammonia vapor from a blast hardening tunnel, hardening room, ice cream freezers and popsicle tanks. Boosters compressed the vapor to 33.5 psig. High staging continued compression to 185 psig.

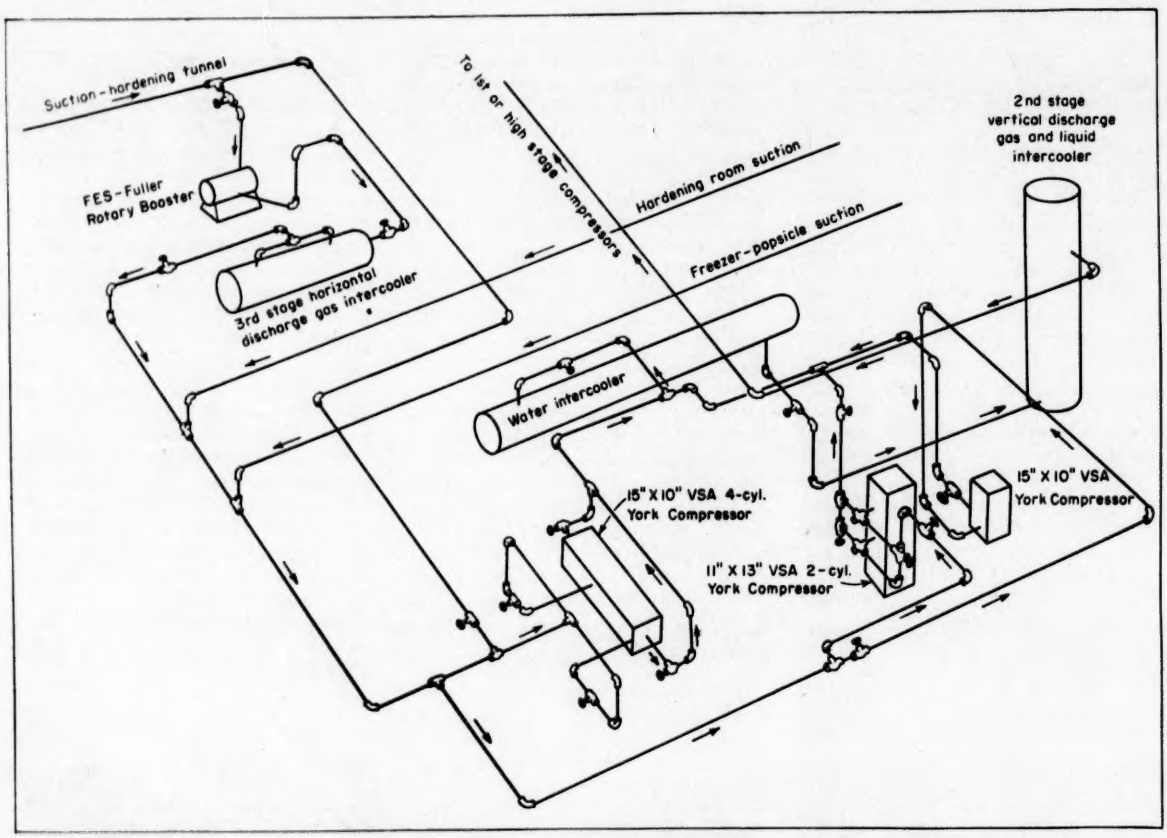
How Third Stage Was Added

A 4-cylinder 15x10 York compressor usually handled the blast hardening tunnel, pumping from 16-in. vacuum to 33.5 psig. Two other reciprocating boosters (another 15x10 and an 11x13, both VSA 2-cyl. units) handled other low temperature loads, pumping from 3-in vacuum to 33.5 psig.

To lighten the duty of the larger 15x10 compressor, it was decided to install a third stage booster on the blast hardening tunnel and allow the 15x10 to also operate from 3-in vacuum to 33.5 psig intermediate level.

An FES-Fuller rotary booster compressor, supplied by Freezing Equipment Sales, Inc., York, Pennsylvania, was selected to handle the requirements of the third stage. The rotary was placed in the suction line from the blast hardening tunnel. A horizontal gas intercooler of FES design was installed in the discharge of the rotary booster to minimize the effect of the heat of compression and cool the vapor passing to the second compression stage. An estimated 62 TR is produced by the rotary booster at 16-in. vacuum.

. . . More ▸


Suction - hardening tunnel
FES-Fuller Rotary Booster
3rd stage horizontal discharge gas intercooler
To 1st or high stage compressors
Hardening room suction
Freezer-popsicle suction
2nd stage vertical discharge gas and liquid intercooler
Water intercooler
15" X 10" VSA 4-cyl. York Compressor
11" X 13" VSA 2-cyl. York Compressor
15" X 10" VSA York Compressor

Schematic Piping Diagram, Three-Stage Compression System, Woodlawn Farm Dairy, Wilkes-Barre, Pa.

Operation of the 4-cylinder 15x10 compressor at the 3-in vacuum is reported to have increased its capacity from 61.2 to 136 TR, with a horsepower increase from 142 to 180 bhp. Reapplication of this compressor evidently more than doubled its capacity with a hp increase of only 27 percent.

It is also interesting to note that the larger 15x10 machine when operating two-stage at 16-in vacuum on the hardening tunnel, produced 61.2 TR with 142 bhp, or 2.4 bhp/TR. This compares with the rotary capacity at 62.0 TR at 33.0 bhp, or .54 bhp/TR.

Staging Advantages

Addition of a third stage produced blast tunnel hardening refrigeration tonnage capacity at the 16-in. vacuum level with less horsepower and made available more refrigeration capacity at the 3-in vacuum level, without adding compressors. Even though the third stage rotary pumped into the 3-in vacuum suction, the reuse of the 4-cylinder 15x10 made available about 75 TR of additional compressor capacity to handle hardening room, popsicle tank and freezers.

Discharge from the second stage boosters is passed through a water-cooled intercooler to remove the heat of compression and is subcooled in a liquid-to-gas cooler before it reaches the first, or high stage of compression. This stage consists of four VSA reciprocating compressors.

How Foremost Benefited

Ice cream production at Foremost's Wilkes-Barre plant now has flexibility needed to maintain annual production of 2.5 million gallons. A variety of products are efficiently handled, including bulk ice cream in 10-qt., 5-qt., 1/2 gal., and pint packages, sandwiches and other specialties. No difficulty is now experienced with insufficient hardening.

Installation of the new third stage rotary compressor was inexpensive because only simple foundations were required. Unused aisle space was selected in the engine room, and the compact rotary was installed there at a further saving in piping costs due to proximity to other equipment.

Rotary Selection

Basically, booster compression is provided to handle a large volume of suction gas at a low compression ratio. Low ratios are essential because of the amount of superheat picked up from long suction lines on low temperature applications.

Rotaries, because of their higher efficiency at low pressure and high volume conditions, are thus a logical choice for low temperature booster systems. Absence of suction and discharge valves on rotaries makes it possible for this type of compressor to be efficient in spite of very low pressure differences across the compressor.

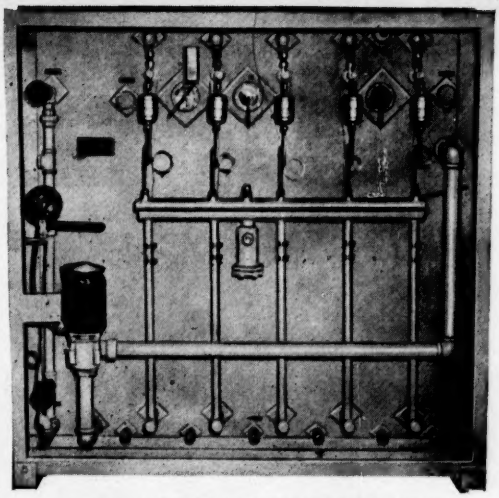
The principle of the rotary being a simple one, reduces maintenance needs. For such reasons as these the rotary was selected by the dairy for the third stage requirements.

Since installation, only routine inspection and automatic lubrication has been necessary to maintain the machine. In service during working hours, it is cut out of the line at the close of the working day, when two stages of refrigeration insure ample capacity.

Normal torque starting motor was used to drive the rotary compressor. Increment starting was not necessary because the unit starts fully unloaded and gradually loads up. The sliding vanes do not form compression cells until sufficient centrifugal force is exerted, which occurs at about 35% of normal operating speed.

Process Illustrations For The Plant Shown On Page 32 ♦

STEP AHEAD with "King Zeero's" NEW Combination PURE WATER COOLER and ICE BUILDER



Front View of PURE WATER COOLER (P.W.C.) installed at Salerno-Megowen's large new baking plant at Niles, Illinois.

For INGREDIENT and WASH WATER APPLICATIONS

Provides a Clear Odorless, Palatable, Cold Water Supply

Equipped with self-contained activated carbon filter, which removes silt, algae and chlorine from city or well water supply. Cools water to 34 degrees Fahrenheit. Pure water is chilled by ice water - prevents freeze-ups. The ideal water for food processing needs, butter or cheese wash, dough water, poultry or produce chilling, or any application where good, cold, clean water is required. Can be connected to present refrigerating machines using ammonia, freon, or methyl-chloride.

The Ice Builder side of the unit may be connected to secondary equipment designed for ice water cooling such as milk coolers, tanks, dough mixers, or air conditioning equipment.

Write for Bulletin PWC 59.

THE KING ZEERO COMPANY
4300-14 W. Montrose Ave.
Chicago 41, Ill.
Manufacturers of Ice Builders - Ice Builder Cabinets - Ice Banks - Pure Water Coolers

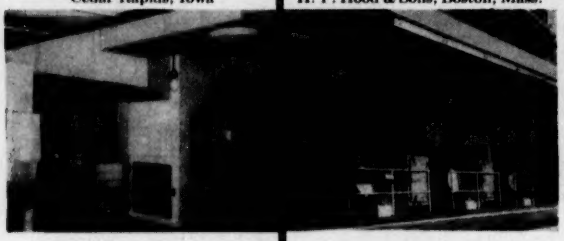
King

SHARP FREEZE SYSTEMS

increase hardening room capacity because they can be located anywhere

INSIDE *the room*
The Borden Company, Cedar Rapids, Iowa

OUTSIDE *the room*
H. P. Hood & Sons, Boston, Mass.



ABOVE *the room*
Oak Farms, Dallas, Texas

BELOW *the room*
Luick's Ice Cream, Milwaukee, Wis.

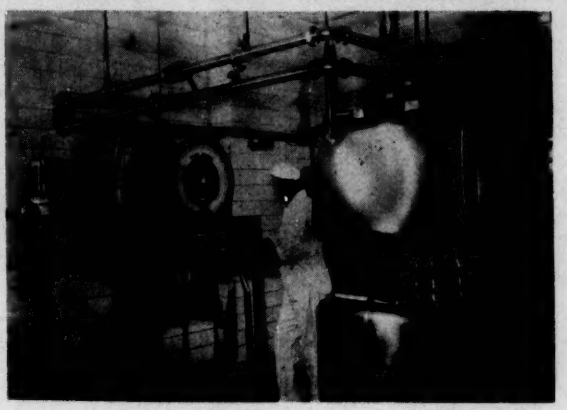
Over 60% of the nation's largest plants have found King Sharp Freeze Systems adaptable to their specific needs. King Systems feature fast, economical air defrost . . . each unit is defrosted 20 to 30 minutes, varying from once or twice a week to once a month. Reduced capacity periods before defrosting or interruption of normal operations during defrosting is entirely eliminated. *Let us show you how to reduce the cost of operating your hardening rooms.*

Write for ***free technical bulletin. More than 50 years experience is at your service.***

King COMPANY OF OWATONNA
907 North Cedar Street

MECHANIZED PRODUCTION FACILITIES NEED PACE-KEEPING REFRIGERATION

Woodlawn Farm Dairy Co., Div., Foremost Dairies Inc.



Operator at pedestal panel directs automatic batch weighing of ice cream ingredients. Automatic ingredient as well as product handling is essential to economic production. Such process efficiencies are often off-set by poor refrigerating practice, outgrown capacity, machinery obsolesence.

Another operator places lids on 10-quart containers of ice cream (only partially frozen) before the bulk packs are conveyed into the blast hardening room, the small opening, center. Frosted line carries product from freezer to filler located over the conveyor at the operators left.

Bagging operation for popsicles and ice cream stick confections, right foreground. Hardened product customarily emerges from freezing tank. In this instance the stick confection passes through an enrober and after-cooler, left.

Industry Meetings

Materials Testing — **Jun. 21-26**
AMERICAN SOCIETY FOR TESTING MATERIALS
Chalfonte-Haddon Hall, Atlantic City, N. J.

Refrig'n & Air Cond'g. — **Jun. 22-24**
AMERICAN SOCIETY OF HEATING, REFRIGERATING & AIR CONDITIONING ENGINEERS
Lake Placid Club, Lake Placid, N. Y.

Food Distribution — **Aug. 10-13**
NATIONAL FOOD DISTRIBUTORS ASSOCIATION
Sherman Hotel, Chicago

International Refrigeration — **Aug. 19-26**
TENTH INTERNATIONAL CONGRESS OF REFRIGERATION
Copenhagen, Denmark

Cryogenics — **Sep. 2-4**
CRYOGENIC ENGINEERING CONFERENCE
University of California, Berkeley

Brewers Exposition — **Sep. 20-25**
MASTER BREWERS ASSOCIATION OF AMERICA
INTERNATIONAL BREWING INDUSTRIES EXPOSITION
Public Auditorium, Cleveland

Meat Packing — **Sep. 25-29**
AMERICAN MEAT INSTITUTE
Palmer House, Chicago

Dairy Conventions — **Oct. 4-10**
DAIRY INDUSTRY SUPPLY ASSN.—Oct. 4-10
Saxony Hotel, Miami Beach
MILK INDUSTRY FOUNDATIONS—Oct. 5-7
Fontainebleau Hotel, Miami Beach
NATIONAL ASSN. OF ICE CREAM MFRS.—Oct. 7-9
Eden Roc Hotel, Miami Beach

Brewing Meet — **Oct. 18-20**
BREWERS ASSOCIATION OF AMERICA
Edgewater Beach Hotel, Chicago

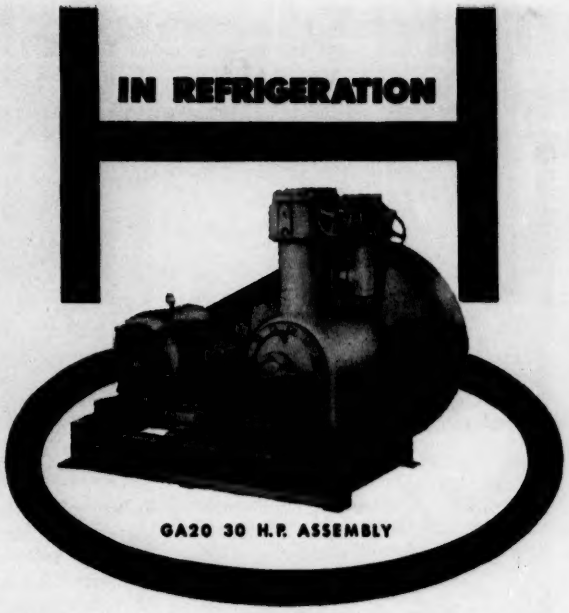
Ice Manufacturing — **Oct. 20-24**
NATIONAL ICE ASSOCIATION
Sheraton-Dallas Hotel

Air-Cond'g & Refrig'n Exposition — **Nov. 2-5**
11TH EXPOSITION OF THE AIR-CONDITIONING AND REFRIGERATION INDUSTRY
Convention Hall, Atlantic City, N. J.

Service Engineers — **Oct. 30-31, Nov. 1-2**
REFRIGERATION SERVICE ENGINEERS SOCIETY
Ambassador Hotel, Atlantic City, N.J.

Ice Engineers — **Nov. 11-12**
SWIMA ANNUAL CONFERENCE OF ENGINEERS
Rice Hotel, Houston

Practical Refrigerating Engineers — **Dec. 9-11**
NATIONAL ASSOCIATION OF PRACTICAL REFRIGERATING ENGINEERS
Roosevelt Hotel, New Orleans



THERE IS A *BIG* DIFFERENCE in refrigeration equipment . . . not so much in the actual materials, although they are very important, but in the in-built intangibles such as the builder's integrity, the engineering experience, the degree of specialization and the manufacturer's reputation.

These are the things that control the profit margins for the equipment's user . . . these are the *important* things that make the *Big* difference.

In Refrigeration—it's *all* in knowing HOWE!

HOWE
ICE MACHINE CO.
2829 MONTROSE AVE., CHICAGO 18, ILLINOIS
Distributors in Principal Cities • Cable Address: HIMCO Chicago

Third Successful NAPRE Conference Prompts Northwest Convention Bid

By CHUCK DEVINE

ANOTHER HIGHLY SUCCESSFUL Pacific Northwest Regional Conference of the NAPRE has been concluded and all 80 of the delegates agreed the program was well arranged and the speakers were of the best in their fields. The conference was capped by a social hour at the Olympia Golf and Country Club. Over 125 persons enjoyed dinner and dancing.

Facilities for the conference were made available by the Olympia Brewing Co., Olympia, Washington, under the general chairmanship of Falconer Anderson, the firm's Chief Engineer. Anderson is National Regional Vice-President, NAPRE.

Interesting and thought-provoking papers were delivered by Chet Bell, Industrial Engineer for Western Engineering, Inc., Portland, Oregon; W. M. Fiander, Sales Engineer for Texas Co., Seattle Division; and Frank Knowles, Manager-Owner of Belt Ice Corp., Seattle. Respective topics were: Automatic Control of Industrial Refrigeration Systems, Characteristics of Oils in the Refrigeration Industry, and Modern Trends in Refrigeration.

Bureau of Refrigeration Information panelists included leading practical engineers from each of the six Northwest Chapters and the three speakers of the day. Left to right, W. M. Fiander, John Anderson, Electrical Foreman, Olympia Brewing, Dick Quam, Chief Engineer, Sick's Spokane Brewery, Bob Harrison, Mechanical Engineer, Boeing Airplane Co., Lynn Mills, Supt., Northwest Ice & Cold Storage, Chet Bell, Frank Knowles, Ralph Williams, District Refrigeration Engineer, Stokely-Van Camp, and Merle Halley, panel moderator and Assistant Engineer, Carling Brewing Co.

Chapter's Represented on Panel

A panel discussion, moderated by Merle Halley, Engineer, Carling Brewing Company, Tacoma, Washington, closed the one-day conference, April 25. Other members of the panel were Frank Knowles, Chet Bell, W. M. Fiander, John Anderson, past president, Olympia Chapter and Electrical Foreman, Olympia Brewing Co.; Richard Quam, president, Spokane Chapter and Chief Engineer, Sick's Brewing Co., Spokane; Lynn Mills, past national director, NAPRE, and Supt., Northwestern Ice & Cold Storage Co.; Robert Harrison, past president, Washington No. 1 (Seattle) and Mechanical Engineer, Boeing Airplane Co.; and Ralph Williams, president, Washington No. 2 (Tacoma) and District Refrigerating Engineer, Stokely-Van Camp Corp.

Capitol Visited

Ladies, 45 of them, were taken on an extensive tour of the State Capitol Buildings, with special side trips into the Governor's and the Secretary of State's Offices, plus a special tour of the Governor's Mansion. The tours were followed by a luncheon and tea in the afternoon.

Olympia Host Committee Chairmen were Bob Jones, Publicity, W. E. Lohrengel, Entertainment, Lyle Premo, Transportation, Roy D. Madison, Registration and Matt LaFontaine, Visitation.

Regional Subordinate Formed

Northwest Chapters patterned the conference this year after the National Conventions. The directors met early in the morning before the conference started, and adopted a set of by-laws by which to govern themselves. Chairman Holmes of the Board of Directors then called the conference into session and after the usual introductions, Merle Halley, Educational Chairman of the day, took over

Scene at the Olympia Golf and Country Club where the conference adjourned with a dinner and entertainment. At the head table are Mr. Frank Knowles, Messrs. and Mesdames Chuck Devine, Merle Halley, Bert Holmes, Falconer Anderson, Chet Bell and Dewey Rigg. Dewey Rigg, Resident Engineer, Olympia Brewing, is credited with the formation of the Olympia Chapter, NAPRE. His inquiry early in 1953 brought the brewery's Chief Engineer, Falconer Anderson to the NAPRE convention at Purdue University. With the urging of the late Professor H. G. Venemann, Olympia Chapter was subsequently founded.

Visitation chairman Matt LaFontaine, Olympia Chapter, directs Northwest delegates to registration desk.

Olympia Brewery and Local Chapter Hosts To Six Units

Frank Knowles, Manager-Owner, Belt Ice Corp. presents an interesting chalk talk to the 3rd Conference.

Industrial Engineer Chet Bell, was lead-off speaker for the educational meeting held at Olympia Brewing Co.

Making a Point, W. M. Fiander, Texas Co., addresses the NAPRE Northwest Conference on compressor oils.

the sessions. The conference adjourned at 4:45 p.m. to reconvene at the Olympia Golf and Country Club for a joint business meeting and entertainment.

Location of the 1960 conference has not been decided upon, but it will soon be announced by the Northwest Board of Directors. Spokane, Portland and Tacoma have made bids for it.

The conference has gone on record as wanting the 1961 National Convention. The names of both Portland and Seattle were mentioned.

Board of Directors, Northwest Regional NAPRE Conference are Falconer Anderson, Regional Vice-president, Olympia; Bert Holmes, Chairman, Olympia; Archie Waterbury, Educational Chairman, Tacoma; Charles E. Devine, Secretary-Treasurer, Olympia; Robert Harrison, Seattle; Anton Wirostek, Portland; Dick Quam, Spokane, Ray Strait, Yakima.

Industrial Members

Sponsoring Members of the Northwest Conference are Arthur Forsyth, Seattle-Spokane-Portland; E. J. Bartells Co., Portland-Tacoma; Belt-Ice Corp., Seattle; Hooker Electrochemical Co., Tacoma; Lewis Refrigeration Co., Portland-Seattle; Matthews Refrigerator Door Co., Portland; Northwestern Ice & Cold Storage Co., Portland; Olympia Brewing Co., Olympia; Power & Controls, Inc., Seattle; W. E. Stone & Co., Tacoma; Terminal Ice & Cold Storage, Portland; Van Waters & Rogers Co., Portland-Spokane-Seattle; Western Engineers, Inc., Portland-Seattle, and York Corp., Seattle.

GET ACCURATE FLOODED SYSTEMS CONTROL

with this level regulator

A SIMPLE CONTROL IS THE BEST CONTROL

PHILLIPS FLOAT CONTROLS

- Proportioning action for smooth feed at all capacities
- Tight Closing with Teflon seat discs
- Self actuation—no electrical or pneumatic connections needed
- Visible liquid level through exclusive "Level Eyes"
- Adjustable level achieves maximum capacity with minimum charge

IN ADDITION — Phillips pilot operated valves are available for all common refrigerants, down to —50° F. Operates with as low as 2 PSI pressure drop and up to 250 PSI with selected springs. Line sizes ½ inch to 4 inches with steel or copper connections.

Solve your flooded system design and application jobs by consulting Phillips. Our firm of engineers have specialized in level control, liquid-vapor separation, liquid circulation and return systems for over 28 years.

H. A. PHILLIPS & CO.
Designers and Engineers
Refrigeration Control Systems
3255 W. Carroll Ave.
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NAPRE CONVENTION TO BE HELD AT NEW ORLEANS

PRESIDENT BURNS DESIGNATES COMMITTEES

Wegener, Chase, Zach Principal Appointees

1959 NAPRE OFFICERS: Top row, l. to r. L. Howat, Sgt.-at-Arms; J. Richard Kelahan, Sec'y; Geo. Paulick and C. W. Sullivan, Directors; Leland Kenagy, Board Chairman. Bottom, l. to r., Quaid Minich, Treas.; Tom Weatherford, Jr., Director; Roy T. Burns, Pres.; Frank L. Chase, Past Pres. and Director; and John N. Mariakis, Vice-Pres. Vice-Presidents M. E. Bell, Falconer Anderson, S. Milton Rambo were absent as were Directors E. Rytlewski and John Muller.

▶▶ PREPARATIONS are under way for the 1959 Annual Meeting of NAPRE. It will be held in New Orleans on December 9, 10 and 11 at the Roosevelt Hotel, Addison E. Wegener, a past National President has been designated convention chairman.

Other appointments by Roy T. Burns, President, are Frank L. Chase as Vice-President and R. E. Zach as educational chairman. Chase is the junior past president of NAPRE and chairman of the Association's Board of Advisers and the nominating committee. Zach, an active member, is an instructor of refrigeration, Mechanical Engineering Department, University of Wisconsin, Madison.

Late Meeting

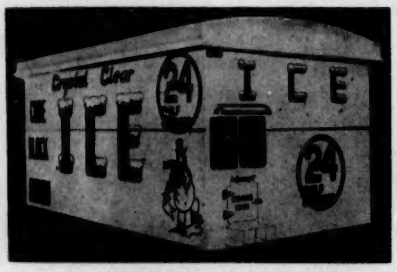
Customarily the Association has met over the Armistice Holiday but deferred its annual meeting this year to December in order not to conflict with the All Industry Show and other refrigeration meetings being held in Atlantic City early in November. John J. Bryner, another past president of NAPRE, chief engineer of the Roosevelt-New Orleans Hotel Corporation, is host.

NAPRE will open a fiftieth anniversary celebration at New Orleans. In 1909 a group of Texas, Arkansas and Louisiana engineers scheduled the 1910 founding at Shreveport.

K. G. BROWN

Presents

the NEW Multi-Screw VENDOR for 1959



Profit-Making Pacesetter in AUTOMATIC Ice Vending

More Sales + More Storage + Less Cost + Less Servicing

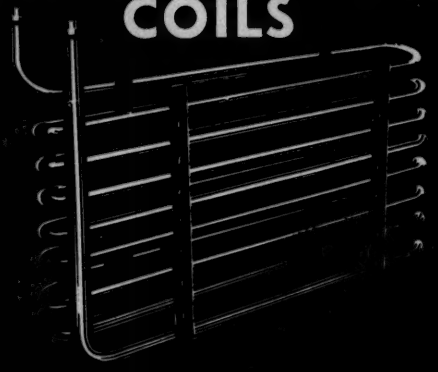
- **An increased capacity of 40% over previous models.**
- **Multi Single Line Vending of any size package or block, regardless of the type of tie.**
- **These new vendors are now made in lengths up to 20' which will vend 268-10# bags plus 132-25# blocks out of the same delivery door, (400 Sales).**
- **Up to 5 various sizes of blocks or bags can be vended from this one vendor.**
- **Radical invention, trouble free, more storage space by design, lower operational cost.**

NEW LOW COST 6' x 8' station vends 110-10# packages, or the "Junior", 3' x 7' station vends 90-10# packages using the new multi screw vendor.

ILLUSTRATED 9' x 16' Station vends 168-10# bags and 86-25# block.

BROWN MFG. CO., INC., MATTITUCK, N. Y.

REFRIGERATION COILS



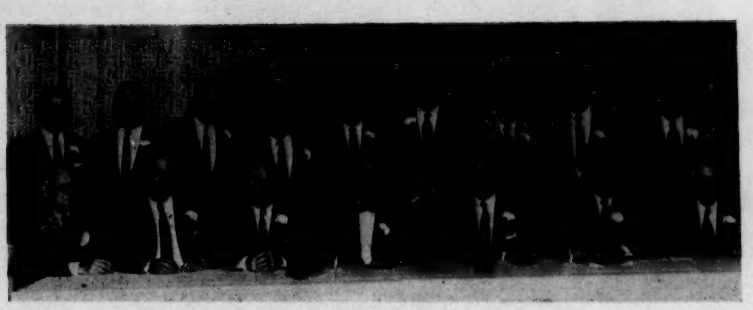
For over 75 years, NATIONAL REFRIGERATION COILS have been known for their smooth bends, perfect welds and accurate measurements ... results of experienced engineering and exact production. The same effective service is guaranteed in all types of NATIONAL COILS, HEATERS, CONVEYORS & HEAT EXCHANGERS.

NATIONAL QUALITY

NATIONAL PIPE BENDING CO.

162 RIVER ST. • NEW HAVEN, CONN.

SOFER HEADS LA. NO. 2 Readies For Convention



LOUISIANA CHAPTER, NAPRE has an impressive executive group in convention readiness, says Max Sofer, Chapter Prexy. Officers and directors as shown at right are: Seated, George J. Whitman, treasurer; Joseph W. Copley, 3rd vice-president; Harold J. McGovern, Jr., 2nd vice-president; John C. Funel, 1st vice-president; Max W. Sofer, president; Leo J. Vivien, secretary; Eugene W. Orth, financial secretary. Standing Frank L. Chase, national past president; Norman Levenson, educational chairman; Wayne Forbes, sergeant-at-arms; Joseph M. DeFraites, Jr., director; Leslie Thomas, director; Joseph Arena, outgoing president and chairman of the board; Ray B. Myers, director; Al S. Ballanco, director and Walter J. Merwin, director.

Ice Cream Plant Tour For Greater Kansas City

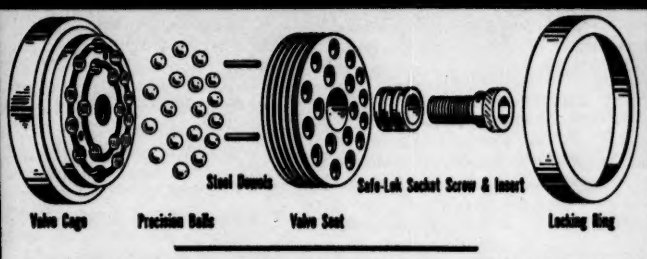
DECOURSEY ICE CREAM CO. was host to the Greater Kansas City Chapter, NAPRE, Tuesday night May 15, 1959. Engineers Dave Grumbling and William Maiden conducted the group through the entire operation. First, attendants were taken through the ice cream hardening and storage rooms, the chill rooms and then through the ice cream processing department. After the ice cream department, the visitors were conducted through the engine room.

Within the past 18 months, Dave and Bill completely revamped their engine room. In their alteration process, they laid out equipment in such a manner that all piping was very clear and simplified. The compressors consist of two high-speed multi-cylinder Creamery Package Mfg. Company boosters, one large York VSA, and a small 7½ x 7½ York VSA. Another York and another small CP multi-cylinder high speed two-stage compressor were piped so that they could, if necessary, be used either on the low side or intermediate suction.

All suction lines were well insulated and the entire engine room was clean and well painted. One interesting item noted was that nearly every unit in the engine room bore a name which we were told, was the first name of one of the present operators or an older operator that had retired or passed on. It was also noted that every switch box and every piece of equipment was identified with a small sign indicating what the unit was or its function.

After a complete inspection trip, the group was conducted into the DeCoursey hospitality room where cake and ice cream were dispensed by Mrs. Grumbling and Mrs. Maiden. It was noted that one or two members were quite conservative in having only one serving while on the other hand, some members, led by Mr. "Red" Edwards, made up the difference by sampling at least one serving of every confection available. After the refreshments, a brief discussion was held in which the secretary read a letter from the Chapter's newest member, Floyd E. Fisher, giving a report on adult extension work as it was available in Missouri.—JOHN G. MULLER.

You Can See The Difference!!!

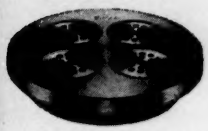


BALL VALVE

TOTALLY UNLIKE ANY OTHER VALVE

Will Increase Performance of ANY Compressor!

For: Y-6½ x 6½



For: Old Style 9 x 9

For: Old Style 12 x 12

- 26% to 80% More Gas Passage
- Less Resistance
- Standardized Assemblies for Most Compressors
- Easy to Install
- Better Seating—Longer Life
- Eliminates Valve Failure or Breakage
- Discharge and Suction Valves in Stock for More Than 100 Different Compressors
- Immediate Shipment

For information on improving performance of your compressors, send us the name, bore, stroke, speed and serial number of each machine.

BALL VALVE COMPANY

5512 OAK STREET • KANSAS CITY, MO.

What's New — (Continued From Page 6)

Low Density Foam

▶CONTINUING the almost month-to-month introduction of new foam product insulations, the Dow Chemical Co. introduced a flexible low density polyethylene foam. The material weighs approximately 2-lbs/cu. ft. and is recommended as a thermal insulation as well as for gasketing and packaging applications.

Fabricated with conventional woodworking or power tools the new line has the customary desirable characteristics of a good insulation. This foam may be adhered to itself, however, by the use of heat alone. It is adhered to common building materials by commercially available adhesives. Special techniques are necessary for coatings.

Dow also manufactures Styrofoam, expanded polystyrene, *Pelaspan*, expanded polystyrene beads, *Scorbord*, a scored plank perimeter insulation, and *Roofmate* for built-up roofs.

Powder Insulation

▶WHILE FOAM materials gain in popularity, another insulating material made in powder form has been introduced, according to FINANCIAL TIMES, London. Said to be 26 times more effective than a vacuum, the powder compound was not named by scientists responsible for developing it.

It is claimed that the material can be used in the construction of plants which would normally require very expensive insulation such as in the storage of liquid hydrogen. Use of conventional insulation techniques for liquid hydrogen storage, according to the London report, permitted very high loss rates. The powder base system reduces the loss rate for on-site storage tanks. Moreover, use of the powder it is claimed, eliminates the need for a nitrogen shield surrounding the hydrogen storage.

Nylon Anchors

▶CONVINCED that some of the more conventional insulations are to remain with us for some time, WHAT'S NEW, introduces here a new anchor for holding insulation furring strips to masonry, concrete and other construction. Holes can be drilled by more common means and these nylon anchors tapped into place. Furring strips, and in some cases insulation itself, can be fastened by means of nails.

The anchors also make an excellent means for fastening air conditioning ducts, piping and conduit to walls and ceilings of masonry construction. A feature is the ability to remove and reuse the anchors. The heads are slotted to take to a screw driver which will back out the nylon anchor.

They are being used by many large construction firms and have been approved by regulatory bodies in such metropolitan areas as New York City. They have been tested for holding and sheer strength by the Pittsburgh Testing Laboratories. Maximum loading of various sizes is given in literature.

More Building Materials

▶LONGER LASTING, a sealing material which is unaffected by extreme temperatures, expansion or contraction, has been developed by a Philadelphia maintenance materials firm. Called *Stonlast*, this resilient material will form permanently weather tight seals in concrete, brick, metal, wood or other material.

It does not shrink and it has been unaffected by temperature changes ranging from minus 50 F to 200 F. It does not contain oil, will not oxidize or become brittle and is not deteriorated by most corrosive vapors. It is packaged as two component fluid pastes which are combined at the job site. It can be applied by trowel, knife or caulking gun, comes in three colors and will remain workable up to three hours at 75 F, and cures in 1½ days.

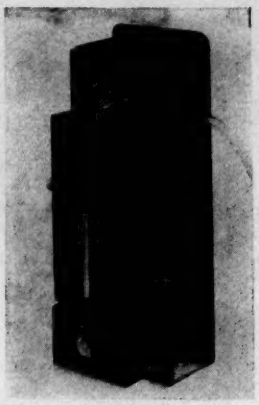
Another product marketed by the same firm and provided in a formulated powder and special liquid binder, is *Stoncap*. The material is designed to stop accidents and is used for resurfacing floors, steps, ramps, etc. It is resistant to greases, fats, oils, brines and foot traffic within five hours, trucks may be rolled on the surface one day later. It may be applied on wet surfaces and is available in five colors.

Water Problems

▶SUMMER brings with it increased refrigeration, not only for industrial processing, but for air conditioning applications as well. With the heat comes microbiological growths in cooling towers and evaporative condensers. A new algacide for controlling such growth for extended periods of time has been developed by a Pittsburgh firm.

Called *Biocide RP*, the new liquid inhibitor is said to be of a wide spectrum, controlling many types of microorganisms including bacteria and fungi, as well as algae. In the development stage of more than two years, this biocide is reported as being equally effective in protecting heat transfer services from the slimy growths, and in controlling the plugging of holes in distribution pans and intake screens.

The material is reported to retain its protective character even when the water is drained out or not circulating. One ounce of the new material per 50 gallons of water is said to provide adequate kill against most types of microorganisms. They can be slug fed or dumped into a system at regular intervals depending on the water analysis.



Automatic Analyzer

▶CHEMALYZER is the unique comparator for automatic determination of water hardness pH residual chlorine, phosphate, hydrazine and dissolved iron concentration. Introduced by the instrument division of a Philadelphia firm, the automatic instrument has but one moving part and requires no electric or pneumatic power for operation. According to the manufacturer no special skills or chemical knowledge is needed to use the instrument since it automatically measures and mixes precise volumes of sample reagent to reveal concentrations.

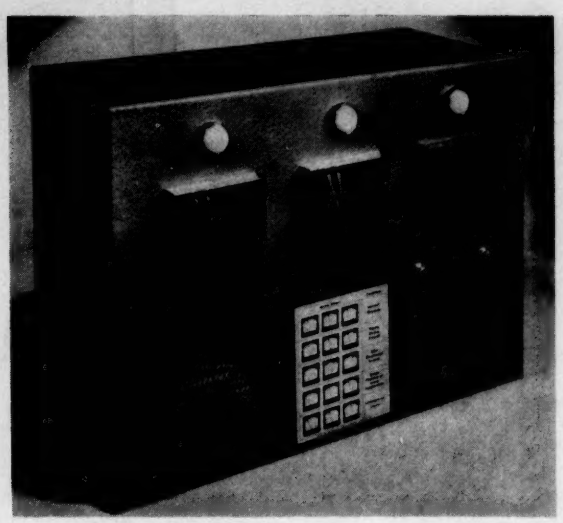
The instrument was originally introduced at the 13th Annual Instrument Society of America Conference and Exhibits in the Fall of 1958. It has been given extensive field tests since that time, with considerable success.

Reaction by water chemists in food processing fields is favorable. One reported to INDUSTRIAL REFRIGERATION: "It is a clever idea and I believe the tester will do what the bulletin says it will do." However, the same party doubts that many refrigeration plants will require process control testing anywhere near the frequency capability of this apparatus. The refrigeration engineer, however, may be doing a favor to the process laboratory in his plant to bring this apparatus to their attention.

Electrical Products

▶WARMER SEASONS also bring considerable electric problems for unwary plant personnel. Those engineers caught up by situations which require replacement of blower motors and fractional ratings for machine tools, will be interested in a new *Thinline* motor that is up to 55 percent shorter and 26 pounds lighter than the standard NEMA Type "D" flange motor of the same rating.

Meeting industry requirements of more horsepower and less space, the motor reduces overhang, increases elbow room for the maintenance mechanic, and its lighter weight makes it easier to install on the original equipment, as well as reducing shipping costs. The versatile drive can be mounted in either vertical or horizontal position, is available in polyphase drip-proof and enclosed construction from 1 to 5 hp at 1800 rpm.

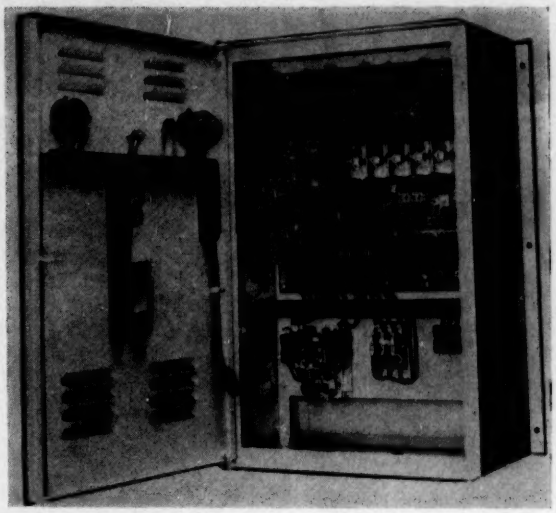


Three Phase Monitor

INDUSTRIAL processing plants, including large refrigerating enterprises, are reported as interested in a three-phase monitor. This instrument can be profitably used by any three-phase power user who has 50 hp or more of connected load. It warns of impending electrical trouble on power lines, such as unbalanced transformer loads, grounds, loose connections and single-phasing.

The instrument has both visible and audible signals, and may be set with minimum and maximum voltage warning points for each phase. Nature of the difficulty can be quickly determined by reading the three voltmeters and comparing them with an illustrated meter chart on the face of the instrument.

The case is all welded heavy gauge metal and may be wall mounted or desk located. Voltmeters are front panel fused and have color-coded dials. The alarm circuit operates from an independent power source of either 110-v ac or 6-v dc. Device comes with transformers for any delta of four wire star systems.



Static Exciter System

DEVELOPMENT has been completed and a Minnesota firm is now in full production of various sizes and types of regulator-exciter systems for the industrial refrigeration and food processing field. The *Kato* static exciter-regulator replaces conventional types of regulators.

Assemblies are mounted together with other necessary controls and indicators in heavy sheet steel wall-mounted, generator base-mounted or free-standing cubicals of dead-front hinged-door type.

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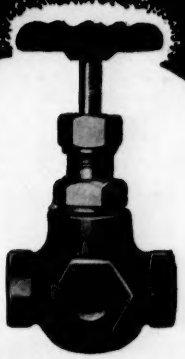

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PERSONS IN THE NEWS—Businessmen, Engineers, Manufacturers

Fred Day Now Manages Ringsby Reefer Division

▶▶DENVER, HEADQUARTERS of the Ringsby Truck Lines, Inc. announced that **Fred E. Day, Jr.**, had been named general manager of the trucking firm's refrigerated division. He succeeds William White. Day will supervise operations of the nearly 100 refrigerated rolling units which operate over a 9,000 mile system.

The new division is tied in directly with Ringsby's central-control dispatch system connecting 13 major terminals between Chicago, St. Louis, Denver and Los Angeles by means of a private communications net work. Day has had over-the-road and refrigeration experience prior to supervisory and executive assignments which led to this appointment, according to **Gail H. Crawford**, Ringsby's Executive Vice-president.

Quinn Takes FGEX Helm Rill Retired in April

▶RETIRED after 48 years of railroad service, **John C. Rill** was succeeded as president of Fruit Growers Express Co., Burlington Express Co., and Western Fruit Express Co., by **John G. Quinn** who had been his vice-president and general manager. The three refrigerator car operating companies operate nearly 22,000 refrigerator cars from one headquarters in Washington, D.C. Nearly 70 railroads are serviced.

For 38 years John Rill held various operating positions with the Pennsylvania Railroad from which he resigned in 1948 to accept the presidency of the associated refrigerator car companies. Under his leadership the organization pioneered the use of mechanically equipped refrigerator cars. The first such car to be placed in general commercial service by these lines, was in 1949. Today the combined operation has over 1200 such units. The car lines' new president, John Quinn has been with that organization since 1951, having prior railroad service since 1934.

TARS Re-Elects Officers

▶MEETING in Chicago recently, Trans-American Refrigerated Services, Ltd., re-elected **Lowell E. Kern**, president. Kern is executive vice-president and general manager of the Terminal Ice and Cold Storage Co. Portland, Oregon. **Dr. H. C. Diehl** was re-elected managing director of TARS.

Other officers re-elected were Vice-president, **Arthur N. Otis**, president, Merchants Refrigerating Co., N. Y. C.; Secretary, **Philip G. Kuehn**, president, Wisconsin Cold Storage, Milwaukee; Treasurer, **Kenneth F. Stepleton**, president, Continental Freezers of Illinois, Inc.; and directors **Herbert Farnsworth**, president, Quincy Market Cold Storage & Warehouse Co., Boston, and **William B. Haggerty**, president, Tampa Cold Storage & Warehouse Corp.

Geo. A. Horne Passes

▶▶THIRTY YEARS of outstanding contributions to the refrigerating engineering field, is one thought that passes through the minds of many in the industry when they see the name of George A. Horne. Mr. Horne died May 13,1959 at the age of 82.

A past president and honorary member of ASRE, Horne's name was linked with refrigerating contemporaries such as Willis H. Carrier, Fred Ophuls, Harry Sloan and others who made vital contributions to the development of industrial refrigeration. Mr. Horne achieved a notable list of engineering papers. According to many, his papers on "Compound Compression" and "A Two Stage Compressor" seemed to be of greatest significance.

A. W. Oakley, another past president of ASRE, and vice-president and secretary of Hudson Refrigerating Company, Jersey City, N.J., relayed the information of Mr. Horne's passing to IR.

"When I went to work for the Merchants Refrigerating Co. in 1918 as Mr. Horne's assistant, the industry was young. By the time of his retirement in 1940, refrigerated warehousing had expended greatly and various refrigeration technique vastly improved.

"If you work closely with a man for 22 years you know him well. In that entire period George Horne displayed daily an undeviating integrity in matters large and small. If a thing was true and right he was its champion; if it were false and wrong he fought it. Having established a fact after the most careful investigation, he then defended it hotly, whether that position was financially expedient or not."

Mr. Oakley pointed out a couplet quoted by the late Mr. Horne on assuming the presidency of ASRE, 1924.

"Make Science the Method
Make Service the Motive"

Oakley concluded that these words were not conventional presidential oratory. George Horne wrote them and spoke them with conviction because he meant every word that he said.

Schrom Heads Grantley, A York Works Division

▶▶NAMED WORKS MANAGER for the Grantley Works, York Div., Borg-Warner Corp., is **David A. Schrom.** He started with York as a Penn State Co-op student. Schrom began his full time work with York on graduation in 1942. He has served successfully as a methods man, industrial engineer, senior general foreman, shop superintendent, plant superintendent, general superintendent.

The new works manager has been active in his profession and in his community. He is a registered professional engineer. Announcement of his appointment came from **E. F. Peslar**, vice-president and director of operations who was recently placed over both Decatur and Grantley Works, York.

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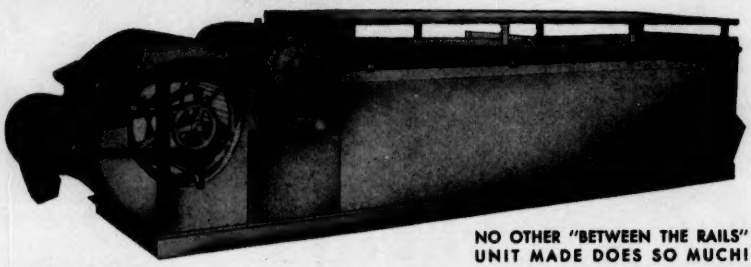

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Booth Fisheries Acquires East Coast Fish Packers

▶▶PURCHASE of the largest Atlantic packers of ocean perch and whiting was announced in May by Booth Fisheries Corporation. The four companies are Fabet Corp. of Gloucester, Mass., Surf Fisheries, Inc., Sunlight Fisheries, Inc. and Bay Freezers Corp. The plants have a processing capacity of more than 20 million pounds and will operate as Booth divisions.

The Fabet affiliates were purchased at an undisclosed price from the estate of the sole owner of the properties, Thomas E. Harrington, according to R. P. Fletcher, Jr., Booth President. The purchase is the second substantial expansion by Booth this year. Fortune Bay Products, Ltd. Newfoundland, had been acquired earlier. The North Atlantic fisheries plant has a processing capacity of 35 million pounds annually.

Acronize For Fish Cleared By New Order

▶▶AUREOMYCIN chlortetracycline, an antibiotic ice and refrigeration supplement, has been given clearance by appropriate government agencies, for use to retard spoilage of fish. The government action was made known by the Agricultural Division, American Cyanamid Co., which manufactures the product under the brand name *Acronize*.

Transportation, ice plants and refrigeration industries will be interested in benefits that can be achieved by the application of this antibiotic to vertebrate fish. Ability of the antibiotic to retard bacterial spoilage which sets in at the moment of the catch, is expected to interest ice plants which will be able to market ice containing *Acronize*.

Applied To Poultry

Acronize is not new in the U.S. An estimated half billion pounds of poultry have been treated with the product since its introduction in 1956. Evidence that it is equally effective in controlling spoilage of fish has been established by intensive research and successful use for two years in Canada and Japan.

Specifically, the tolerance of *Acronize* permitted according to the wording of the order is "5 ppm. in or on fish (vertebrate), scallops (shucked), shrimp (unpeeled) from application for retardation of spoilage to whole, headed or gutted fish (vertebrate); scallops (shucked); shrimp (unpeeled); each in fresh, uncooked unfrozen form." After cooking, virtually no antibiotic is found.

Forecast 300% Increase In Refrigerated Cargoes

▶▶OPENING OF the St. Lawrence Seaway has brought predictions from shipping agents that there will be a big boost in both incoming and outgoing cargoes of refrigerated food stuffs. FINANCIAL POST, Toronto, reports the import business of refrigerated products is already brisk. However, they expected the export picture to be less rosy.

The shortage of refrigeration facilities on the docks has been offered as one slight deterrent to the rapid pick-up in refrigerated water commerce. The second problem is the justification of refrigerated space on outbound vessels.

Outbound shipments of frozen livers, tongues, kidneys and poultry are predicted, with canned meats, frozen fish, fillets, frozen berries from various European countries, fresh fish from the United Kingdom, Swiss and Danish cheeses, expected among the imports. One Chicago exporter with a subsidiary in Toronto, is reported as offering 553,000 cu. ft. of refrigerated space this year as against 153,000 cu. ft. last season.

New U.S.C.S. Officers

▶▶AMONG THE LARGEST companies in the refrigerated warehouse industry, U. S. Cold Storage Corp. was recently acquired by the American Ice Company of New York City. In May, the organization held its first meeting under the new management. The new officers of the cold storage corporation, according to a release from the Chicago, Illinois headquarters are: Joseph S. Robinson, chairman of the executive committee; Peter A. Buehrman, president; Richard M. Conner, executive vice-president; E. E. Seymour, C. E. Olson, R. L. Smith, vice-presidents; P. R. Gates, treasurer; L. Gambon, secretary; and Ruth Schure, asst. secretary. Peter Buehrman at present is vice-president of the National Ice Association, and an executive of American Ice Company, as is Joseph S. Robinson.

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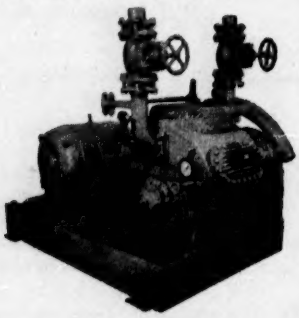

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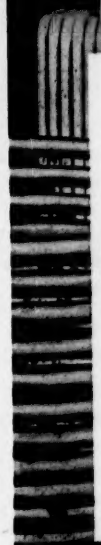

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View of the two, 8-cylinder, Vilter VMC ammonia compressors installed in the Pepsi-Cola Bottling Company's new Cincinnati plant. On the right is Mr. Albert M. Olsen, Chief Engineer.

Be Bright! Be Light!
Have a Pepsi!

PEPSI-COLA

BE RIGHT! BUY RIGHT!
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This new Pepsi-Cola Bottling Company plant houses three high-speed bottling lines capable of producing over 7,000,000 cases of Pepsi-Cola yearly.

"You can relax with Pepsi and with Vilter refrigeration,"

says Albert M. Olsen,
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The dependable performance of Vilter VMC compressors is the result of tireless engineering improvements: protection against refrigerant slugs, built-in capacity reduction; precision manufacturing techniques; painstaking inspection; careful assembly; and factory-run-in tests.

Why not call on your nearest Vilter Distributor for help with your refrigeration problem.

Sold and installed by Vilter Distributor, C. P. Wood & Co., Cincinnati, Ohio.

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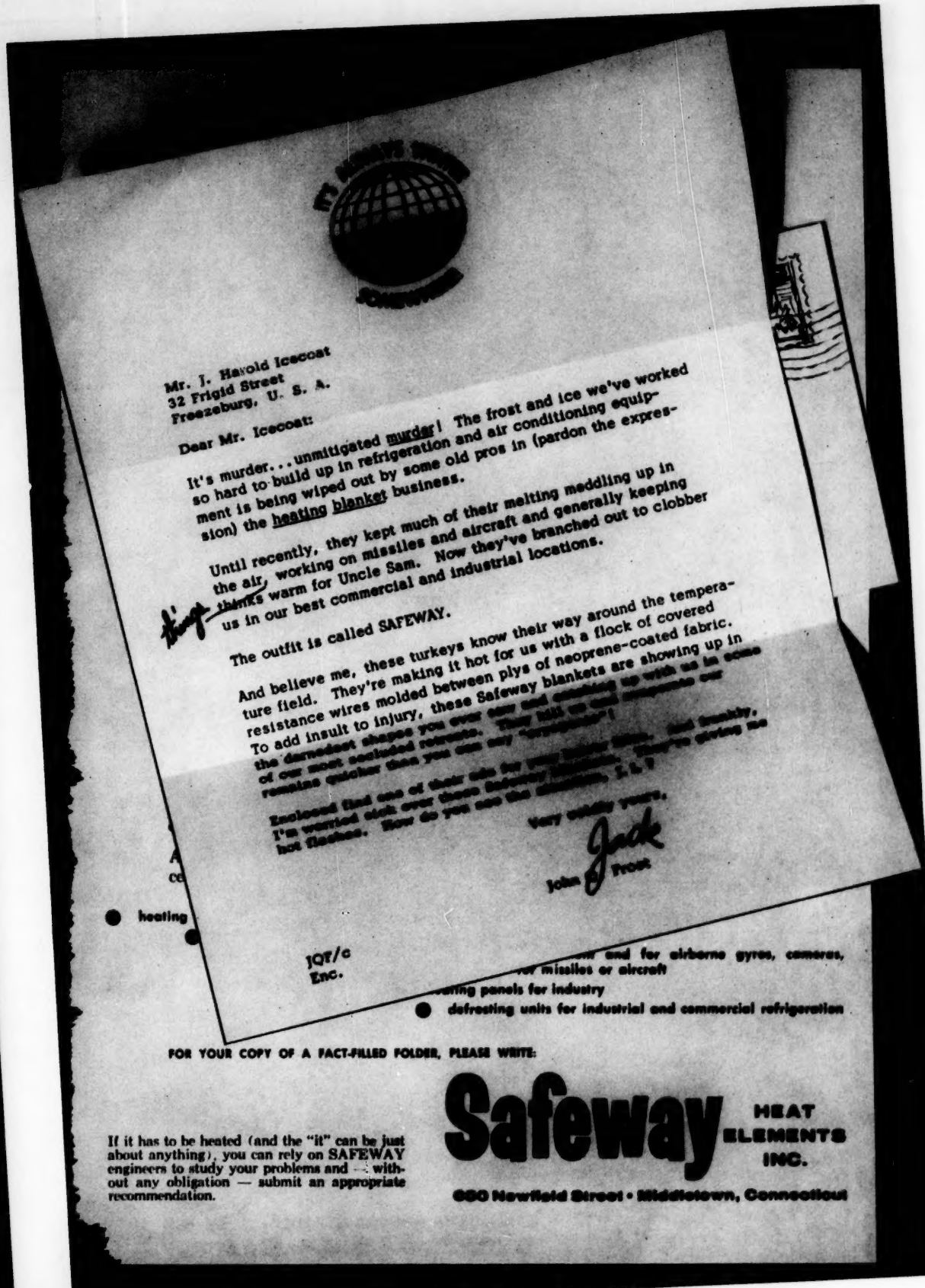
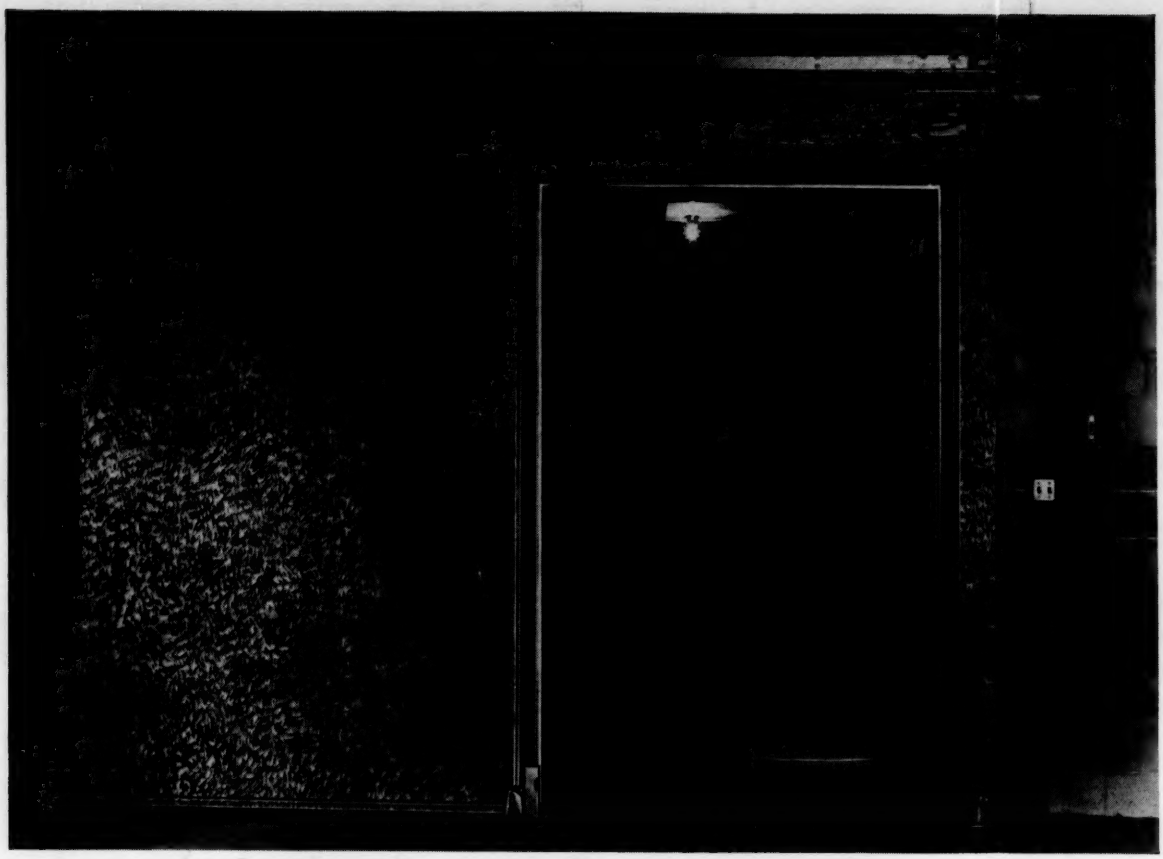
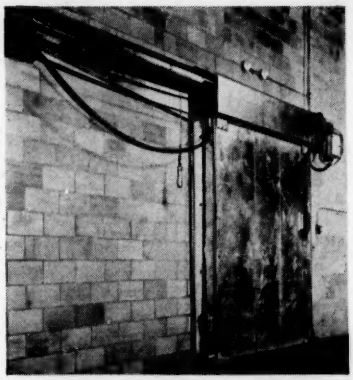
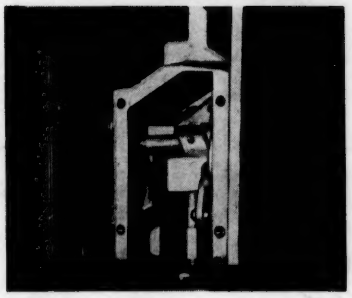

Mr. I. Harold Icecoat
32 Frigid Street
Freezeburg, U. S. A.
Dear Mr. Icecoat:
It's murder...unmitigated murder! The frost and ice we've worked so hard to build up in refrigeration and air conditioning equipment is being wiped out by some old pros in (pardon the expression) the heating blanket business.
Until recently, they kept much of their melting meddling up in the air, working on missiles and aircraft and generally keeping us warm for Uncle Sam. Now they've branched out to clobber us in our best commercial and industrial locations.
The outfit is called SAFEWAY.
And believe me, these turkeys know their way around the temperature field. They're making it hot for us with a flock of covered resistance wires molded between plys of neoprene-coated fabric. To add insult to injury, these Safeway blankets are showing up in
Enclosed find one of their ads for your [illegible]. I'm worried sick over these [illegible]. How do you see the situation, J. F.?
Very coldly yours,
John Frost
jqf/c
Enc.
heating
and for airborne gyros, cameras,
missiles or aircraft
panels for industry
defrosting units for industrial and commercial refrigeration
FOR YOUR COPY OF A FACT-FILLED FOLDER, PLEASE WRITE:
If it has to be heated (and the "it" can be just about anything), you can rely on SAFEWAY engineers to study your problems and — without any obligation — submit an appropriate recommendation.
Safeway HEAT ELEMENTS INC.
600 Newfield Street • Middletown, Connecticut





FAST OPERATION of Electroglide Freezer Door saves refrigeration. Note Jamison Frostop® installed to prevent icing and freezing.



POSITIVE SEAL. When door reaches closed position, exclusive Jamison camming action forces door *in* and *down*.

Photos Courtesy: National Tea Company,
Council Oak Stores, Sioux City, Iowa
Insulator: Low Temp Insulations, Omaha, Nebraska

In-and-out freezer room traffic speeded up by Jamison Electroglide® Doors

The efficiency and economy of Jamison's new Electroglide Power Operated Door are assured by special Electroglide features—available in no other door.

RANGE OF TYPES—Available as bi-parting and single leaf right or left hand.

LEVEL RIDE—Door opens and closes without gasket drag or wear.

SAFETY—Full height safety edge reverses door instantly on contact.

EMERGENCY CONTROLS—Manual operation when power off; emergency release from inside when padlocked outside.

Get the complete story on Electroglide Cooler and Freezer Doors. Write today for new bulletin to Jamison Cold Storage Door Co., Hagerstown, Md.

JAMISON

COLD STORAGE DOORS